Appendix 2

MINIMUM REQUIREMENTS FOR SAFER HOUSING

MINIMUM REQUIREMENTS FOR SAFER HOUSING

The Minimum Requeriments are established in conformity with
Peruvian National Building Code

JICA Study Team

1. Quality of Materials
2. Structural Section of Main Members
3. Connection of Structural Members

1. Quality of Materials

1.1 Concrete

a) Mixture design for reinforced tie beam is one (1) portion of Portland cement, two (2) portions of clean coarse sand, four (4) portions of crushed stone (the size is less than 1/2") and one (1) portion of clean and drinkable water. Mixture design for non reinforced tie beam is one (1) portion of Portland cement, eight (8) portions of hormigon, two and half (2.5) portions of medium stones (the size is maximum 4") and one and quarter (1.25) portions of clean and drinkable water.

   Mixture design for confined columns, ring beams and light slab is one (1) portion of Portland cement, two (2) portions of clean coarse sand, three (3) portions of clean crushed stone (the size is less than 1/2") and one (1) portion of clean and drinkable water.

   In case of salty soil for foundation, vinyl sheet is used to prevent salt damage of concrete.

b) Materials are well mixed where the aggregate is not visible and poured to form work immediately.

c) Form work is hard and no bleeding.

d) Any gaps and void is avoided by using a stick to compact concrete when it is pouring.

1.2 Mortar

Mixture design is one (1) portion of Portland cement and four (4) portions of clean coarse sand.

1.3 Foundation

Mixture design for foundation is one (1) portion of Portland cement, ten (10) portions of hormigon, one and half (1.5) portions of clean and drinkable water and three (3) portions of large stones (the size is maximum 10")

Hormigon is composed of gravel and coarse sand directly obtained from quarry place

1.4 Wood

Wood is hard, dry, dense fiber, well cured, no crack and straight.

1.5 Brick

Brick is burned and orange color without white pale shadow. Brick is also dust free, without cracks or bending.

1.6 Water

Water is clean and drinkable.

2. Structural Section of Main Members

Wall of confined masonry house is enclosed firmly with reinforced concrete tie beam, reinforced concrete column and reinforced concrete ring beam on a stable foundation with enough strength. Every vertical part of wall corner is firmly connected, forming confined elements.

2.1 Foundation

Foundation width and height is 60 cm or more. In case of the foundation without loads from small beams of roofing, the width of foundation can be 50 cm. Foundation depth is no less than 80 cm.

2.2 Sections of reinforced concrete member

a) Tie beam width is 13 cm or 24 cm according to the width of the wall. The minimum height is 50 cm. Tie beam is reinforced with four (4) steel bars of 3/8" diameter, with stirrups of 1/4" diameter at 20 cm intervals. If the soil is mainly composed of slime and/or sand, the tie beam is needed to be reinforced.

b) Maximum wall area framed with tie beam, column and ring beam is 12.0 m2. The maximum height of the wall is 2.4 m.

c) Column has a minimum section of 13 cm wide and 15 cm high, and four (4) steel bars of 3/8"diameter are placed with hoops of 1/4" diameter. Five (5) hoops are placed from the connection point with tie beam. First hoop is placed at 5 cm from the connection point. The other four (4) hoops above the first hoop are placed at 10 cm interval. Another five (5) hoops are placed from the point with ring beam as the same case from the connection of tie beam. At the rest space of column hoops are placed at 25 cm interval.

   Additionally, two (2) stirrups are placed in joint of column and ring beam at 10 cm interval. Three (3) stirrups are also placed in joint of column and tie beam at 15 cm interval.

d) Minimum dimension of ring beam is 13 cm wide and 20 cm high, and four (4) steel bars of 3/8"diameter are placed with stirrups of 1/4" diameter. Five (5) stirrups are placed from the connection point with column. First stirrup is placed at 5 cm from the connection point. The other four (4) stirrups beside the first stirrup are placed at 10 cm interval. Another five (5) stirrups are placed from the connection point with the other column as the same case from the connection of the other above mentioned column. At the rest space of ring beam space stirrups are placed at 25 cm interval.

e) Minimum covering depth of concrete is 2 cm for walls with finish and 3 cm for walls without finish. In case of foundation, covering depth is 7.5 cm.

f) Minimum length of structural wall is 1.2 m.

2.3 Maximum span

Maximum span of columns is 5.0 m in case of 24 cm wide wall. It is 3.5 m in case of 13 cm wide wall.

3. Connection of Structural Members

3.1 Anchor of column to tie beam and ring beam

Four (4) steel bars of column anchore to the foundation. The steel bars bend 90° at 7.5 cm from the bottom of foundation. The bended steel bars are prolonged 25 cm. In case of reinforced tie beam, the steel bars of column and tie beam must be carefully tied by steel wires to ensure an adequate connection between these structural elements. In case of good soil, concrete without reinforcement is used.

In the same way, four (4) steel bars of column anchore to reinforced ring beam. The steel bars bend 90° at 2 cm from the top of ring beam. The bended steel bars are prolonged 25 cm measured from the column surface.

3.2 Connection of wall and column

There are two connection methods. One is that joint between wall and columns is geared and the length of the salient part of brick does not exceed 5 cm. The other is that two (2) steel bars of 1/4″ diameter anchor at every four (4) layers of wall bricks at least 40 cm inside masonry and 12.5 cm inside column with vertical turning of 90° at 10 cm.

3.3 Overlapping of reinforcements

Steel bars of reinforced concrete overlap at least at 40 cm.

3.4 Wall joint mortar thickness

Thickness of joint mortar for wall is from 1.0 to 1.5 cm.

Appendix 3

AUTHORIZATION OF MINIMUM REQUIREMENTS BY THE DIRECTOR OF CISMID

Authorization of minimum requirements by Dr.Zavala, director of CISMID

In the next table, the communication between JICA Study Team and Dr. Zavala in the period of September 13rd and September 18th is described. The principal issue at that time was the consultations of technical items in the preparation of Minimum Requirement for Safer Housing. Until the september 13rd, the JICA Study Team had prepared version in spanish and english of minimum requirements (in consultation with Dr. Zavala) and since that date, the last consultations is show below

Date	Description of the communication between JST and Dr. Zavala	Attached files in mail
Septemb 13rd	JST send last version of Minimum Requirements	Requerimientos minimos_version final13_09.doc , Minimum_Requirements_final version13_09.doc
Septemb 16th	JST send some consultations regarding foundation and quantity of hoops in joint column-tie beam	
Septemb 16th	DZ answer the questions of last mail. He is agree with reduce width of foundation and place 3 hoops in joint column-tie beam	
Septemb 17th	JST take note of reply and send poster of minimum requirements to DZ	POSTER REQUERIMIENTOS MINIMOS A1 FINAL (Acero).jpeg
Septemb 18th	JST ask DZ about the possibility of desestimate the use of additional steel bars because of congestion of steel bar in the joint (for dimension of column)	plano zavala-Model.pdf
Septemb 18th	DZ accept the suppressing of additional bars in this case	
At this time, the version of Minimum Requirement for Safer Housing presented to Dr. Zavala on September 13rd, was changed according to the indications of him. The minimum requirements document was made as a paper and as a poster and these are show in Appendix 2 and Appendix 9		

Appendix 4

FINAL REPORT OF PILOT PROJECT No. 1 PREPARED BY THE LOCAL ENGINEERING COMPANY CONTRACTED WITH THE JICA STUDY TEAM

PROJECT:

"PROVISION OF THE RECONSTRUCTION OF SAFER HOUSING" STUDY OF RECONSTRUCTION OF SEISMIC-RESISTANT HOUSING IN THE REPUBLIC OF PERU

REGION : ICA
PROVINCE : ICA
DISTRICTS : PUEBLO NUEVO, INDEPENDENCIA, LA TINGUIÑA

October 2008

CONTENTS

DESCRIPTIVE REPORT OF ARCHITECTURE

PROJECT:

"PROVISION OF THE RECONSTRUCTION OF SAFER HOUSING" - STUDY OF RECONSTRUCTION OF SEISMIC-RESISTANT HOUSING IN THE REPUBLIC OF PERU

REGIÓN : ICA

PROVINCE : ICA

DISTRICTS : PUEBLO NUEVO, INDEPENDENCIA, LATINGUIÑA

1. BACKGROUND AND JUSTIFICATION

On August 15th 2007 a big earthquake shook the cost of the Ica Region with a lot of victims and material damages. According to the information given by the INEI 52,134 houses that collapsed as a consequence of this earthquake.

The evaluation made after the earthquake by the JICA Team, confirmed the needs to promote the reconstruction of seismic-resistant houses in order to reduce the risks of damages for future earthquakes.

Upon request of the Peruvian Government the JICA Team developed the project named STUDY OF RECONSTRUCTION OF SEISMIC-RESISTANT HOUSING IN THE REPUBLIC OF PERU.

2. DESCRIPTION OF THE PROJECT

The project STUDY OF RECONSTRUCTION OF SEISMIC-RESISTANT HOUSING IN THE REPUBLIC OF PERU is located at the 3 districts corresponding to the 3 provinces of the Department of Ica named Pueblo Nuevo, Chincha; Independencia, Pisco; and, La Tinguiña, Ica.

This proposal will be developed at the existing lands belonging to the different beneficiaries located at the 3 important districts

The architecture of the project is directed by the following structural principles:

Economy and diversity. The project proposes prototypes of houses in a progressive process of consolidation based on the budgets proposed by the National Government at the Programs Bonus 6,000 and BHF; it is also considered the use of materials of good quality inclusive if they are materials from the zone.

Stage: As a result it is proposed 4 prototypes of housing which comes from a module of a single room to a basic module of housing formed by rooms, social rooms and services.

Self-construction: The constructive process includes (because of the reduced economic resources) the self-construction which is reinforced by the "Manual of Watching for the Construction of Safer Housing" which looks to warrant the fulfillment of the project objective.

Safety: Before the possibility of future earthquakes it is determined the design of the structural elements and therefore the dimensions and proportions of the architectonic components.
Likewise it was taking into consideration the following Design Considerations:

It was considered the regulations set forth by the National Regulation of Construction, and specifically those related to the Title III.1, Architecture, Standard A.010, General Conditions of Design; Standard A.020, House.

Detailed Description of the Project:

Prototype 1 – Bonus 6000: Constituted by one room which some times will be used as a bedroom, with a constructed area of 10.38 m2. The process of growth are directed to the bottom and left side at the entrance.

Prototype 2 – BHF 13400: Constituted by two rooms, one bedroom (Prototype 1) and Social Area with a constructed area of 35.47 m2. The process of growth is directed to the bottom. There are two variants; one has a bathroom and the other one has not for that reason the growth area are totally occupied by the social area.

Prototype 3 – BHF 16400: Constituted by three rooms, to the prototype 2 it was added the area destined to the kitchen, it has a constructed area of 43.23 m2. The process of growth is directed to the bottom. There are two variants; one has a bathroom and the other one has not.

Prototype 4 – 19400: Constituted by 4 rooms, two bedrooms, social area and kitchen. It has a constructed area of 53.13 m2. There are two variants; one has a bathroom and the other one has not.
Another variant of this module is the possibility to construct a second plant.

In the prototypes that have not bathrooms at the modules it is recommended the construction of a latrine at the bottom side of the house.

3. METHODS OF WORK EXECUTION

The construction of houses will be developed by the method of Auto-construction

4. COSTS ANALYSIS

The unitary cost analysis has been developed taking into consideration the performance at the cost zone. The prices of the consumables are determined according to the pricing performed at the localities of Chincha, Pisco and La Tinguiña during the months of August and September 2008.

5. FINAL CONSIDERATIONS

The work will be executed according to the plans and technical specifications. Any amendment during the work execution which could modify the original project (lines, elevations, materials, finishing etc.) will be responsibility of the beneficiaries. Therefore, the team in charge of the project has any responsibility in case there will be amendments without the approbation or consultancy.

Manuel Málaga Lazo
Arquitecto CAP 6425

DESCRIPTIVE REPORT OF STRUCTURES

PROJECT:

"PROVISION OF THE RECONSTRUCTION OF SAFER HOUSING" STUDY OF RECONSTRUCTION OF SEISMIC-RESISTANT HOUSING IN THE REPUBLIC OF PERU

REGION : ICA
PROVINCE : ICA
DISTRICTS : PUEBLO NUEVO, INDEPENDENCIA, LA TINGUIÑA

1.0 OBJECTIVE OF THE PROJECT

The Project has 04 prototypes designed to guarantee in a future a safer house that can resist vertical and seismic forces. This project is projected to a sector of the population of the districts of Pueblo Nuevo, Independencia and La Tinguiña of the Department of Ica which has been effected by the earthquake occurred on August 15th 2007.

This project pretends to facilitate to the settler the drawings of all the specialties to construct a safer housing that can resist seismic forces without the necessity to hire experts and professionals in different areas. This project was developed in order that the prototype #1 could be expanding by stages to become the prototype #4.

Likewise all the prototypes are projected to have 2 levels in unfavorable conditions respect to the kind of soil. The project shows 2 alternatives according to the economy of the family, the first with ribbed slab and the second is a combination of guayaquil cane with crushed cane, plastic and cake of mud with straw.

It has been prepared also a Manual of Watching that can be used for the owner to watch the construction and the master mason, with this manual it is pretended to have a better construction of the housing.

The budgets of all the prototypes have been calculated taking into consideration that the constructive process will be by self-construction and not by contract, for that reason the unitary costs were taken as average reference of the three districts where this project will be developed.

For the structural design the following structurals codes E.010, E.020, E.030, E.060 and E.070 have been used. Likewise, it has been prepared the minimal requirements set forth at the Manual of Watching. It is necessary to note that the Manual of Watching can be used also as a visual guide of the technical specifications.

2. BACKGROUNDS

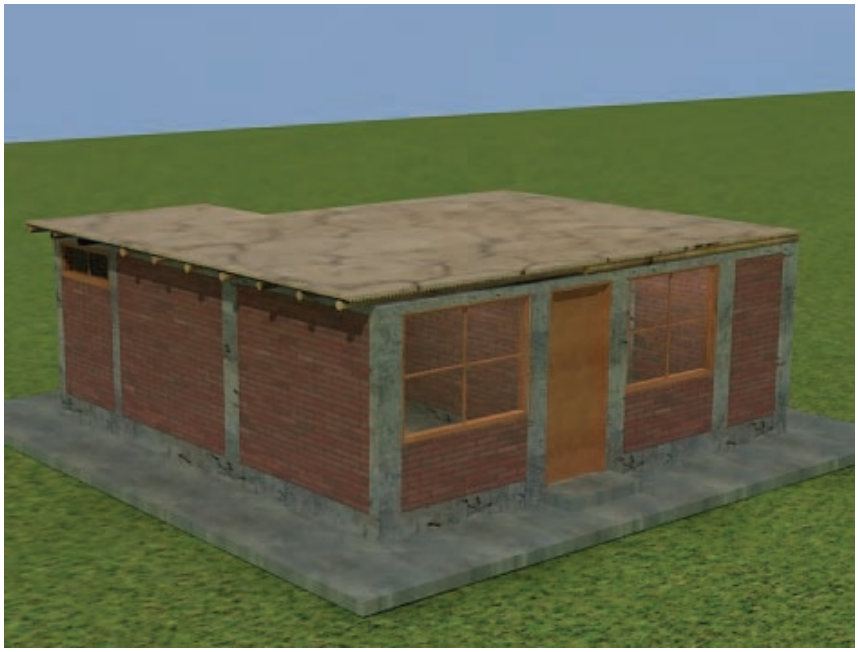
The Ministry of Housing, Construction and Sanitation has a bank of projects where these prototypes will be included. In that way all the prototypes could be used by the settlers of Pueblo Nuevo, Independencia and La Tinguiña and they could used the

bonus of S/ 6000.00 nuevos soles granted by the government of Peru. It is important to establish that this amount is only to construct the prototype #1

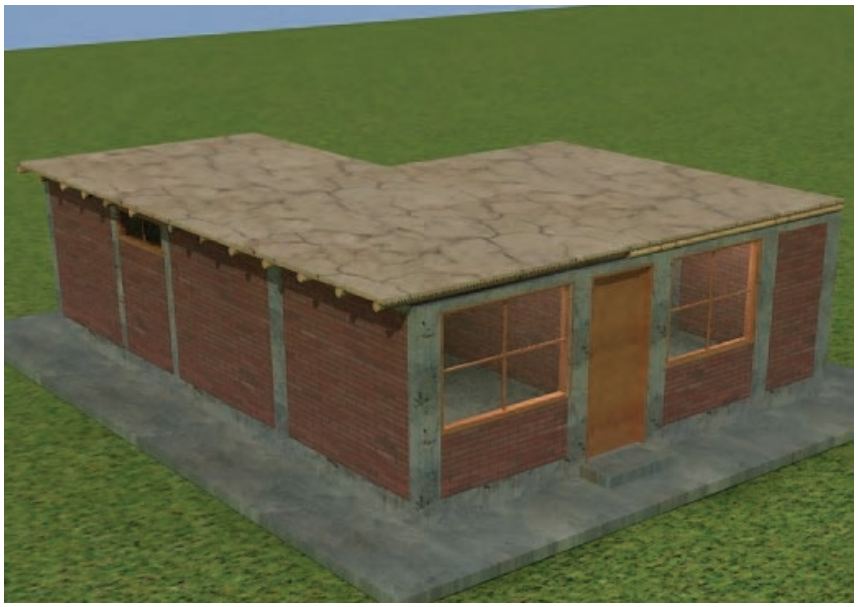
3. LOCATION AND DISTRIBUTION OF THE PROTOTYPES

All the prototypes will be constructed in the cities of Pueblo Nuevo, Independencia and La Tinguiña. Their architectural characteristics are showed in the drawing and in the following views made in 3D.

PROTOTYPE 1



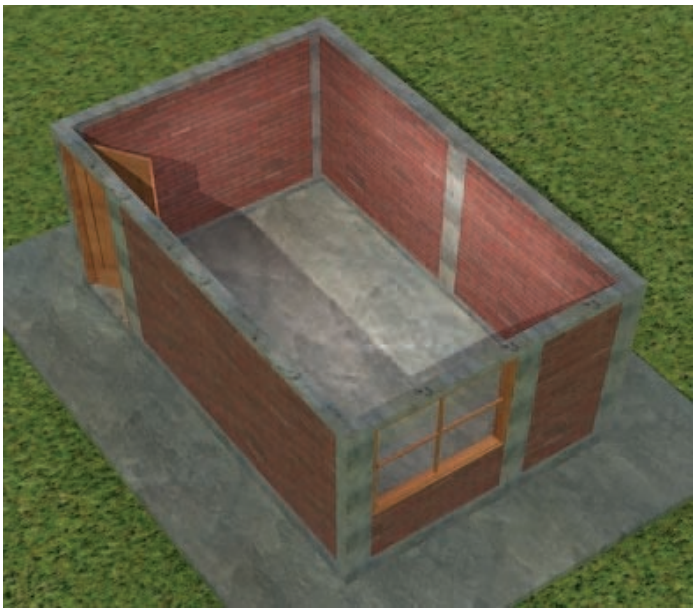
PROTOTYPE 2



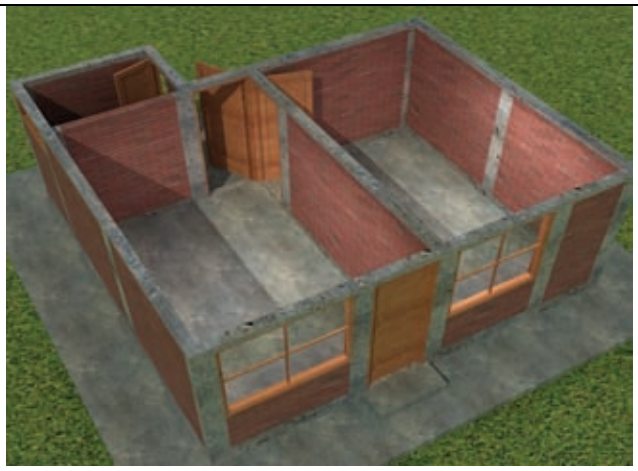
PROTOTYPE 3

PROTOTYPE 4

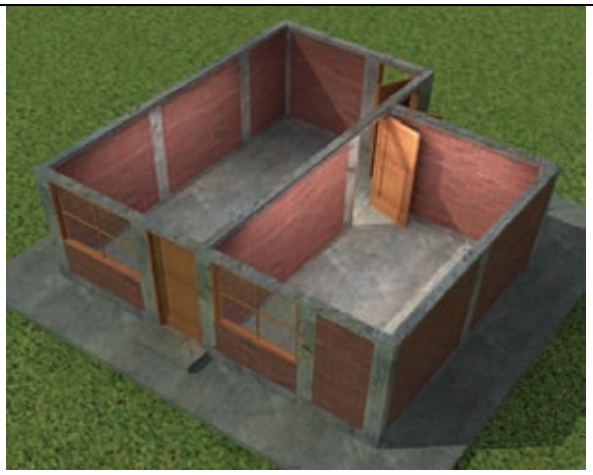
JOSÉ ALBERTO AGERO MARTÍNEZ
INGENIERO CIVIL
Reg. del Colegio de Ingenieros Nº 80207



PROTOTYPE 1

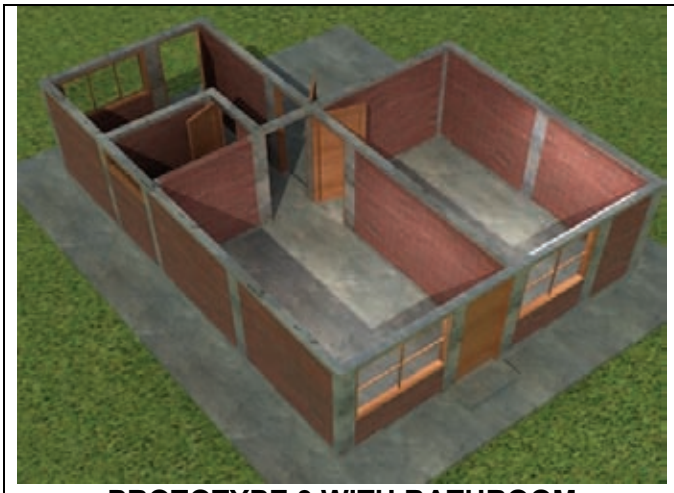


PROTOTYPE 2 WITH BATHROOM

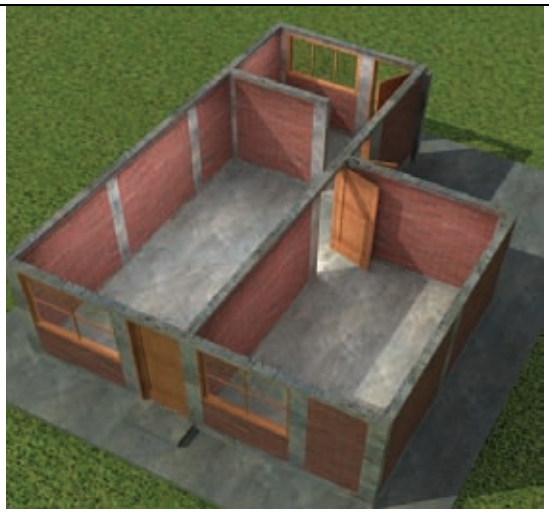


PROTOTYPE 2
WITHOUT BATHROOM
Alternative

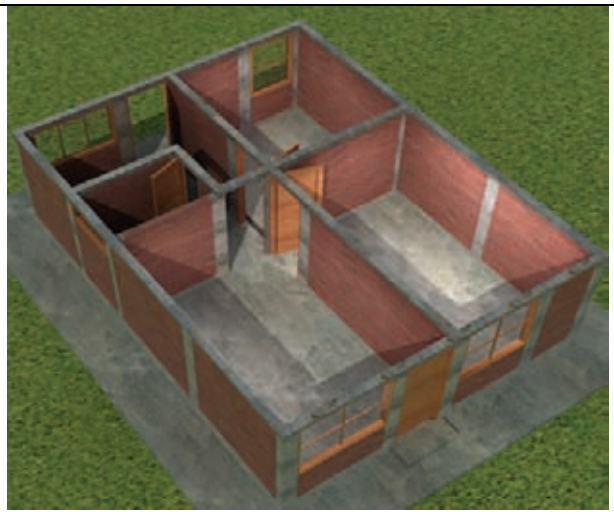
JOSÉ ALBERTO AGERO MARTÍNEZ
INGENIERO CIVIL
Reg. del Colegio de Ingenieros Nº 80207



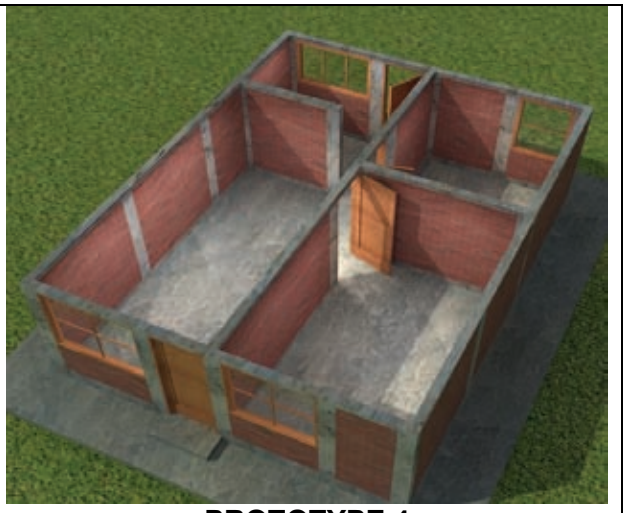
PROTOTYPE 3 WITH BATHROOM



PROTOTYPE 3
WITHOUT BATHROOM
Alternative



PROTOTYPE 4 WITH BATHROOM



PROTOTYPE 4
WITHOUT BATHROOM
Alternative

4. STRUCTURAL CHARACTERISTICS

The project has the following general characteristics:

- The foundation will have a minimal depth of 0.80 m and a wide of 0.50 m to 0.60 m.
- The foundation soil records regular conditions of carrying capacity approximately of 1.20 kg/cm2 to more which footing will not have steel as reinforcement. In other zones of the three districts it has carrying capacities from regular to low of 0.80 kg/cm2 a 1.20 kg/cm2 which footing will have steel bar of reinforcement.
- The prototypes will be constructed with handcrafted brick

JOSÉ ALBERTO AGERO MARTÍNEZ
INGENIERO CIVIL
Reg. del Colegio de Ingenieros Nº 80207

- The structural system of the prototypes is made of confined masonry. To guarantee the confined masonry system it is necessary to have two confinement columns and a ring beam.
- The initial cover has been made taking into consideration a roof made of guayaquil cane + crushed cane + plastic (polyethylene) + mud cake + straw in order to have a low cover but the owners in a future could have the possibility to construct with ribbed slab.

With this information it has been considered a matrix that depends of:

- The kind of soil (with reinforced tie beam or without it)
- The kind of cover (with roof cane or with voided roof)
- Available of Electric Power (if it has or not)
- Available of Water and Sewage (with bathroom or without it = latrine)

Combining this characteristic in the matrix for each prototype it has 16 packages that contains plans, measurement, costs, budgets and list of material (all specialties) being a total of 64 prototypes to be delivered to the Ministry.

The following are the codification of these prototypes in each matrix; it is also shown the amount of each prototype.

CONSTRUCTION AREA		KIND OF SOIL / FOUNDATION		KIND OF ROOF	ELECTRICAL INSTALLATIONS	KIND OF SANITARY INSTALLATIONS	CODIFICATION	COST S/.	COST S/. INCL. IGV
		CHARACTERISTICS	FOOTING						
PROTOTYPE 1 BONUS 6000	AREA 16.38 m2	REGULAR RESISTANCE GRANULAR MATERIAL WITHCOBBLES OF SMALL TO BIG STONES s Acceptable soil 1.2 @ Mas kg/cm2	SIMPLE	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	WITH LATRINE	PROTOTYPE 1 # 01	6,844.82	8,145.34
						WITHOUT LATRINE	PROTOTYPE 1 # 02	5,900.64	7,021.77
					NOT AVAILABLE	WITH LATRINE	PROTOTYPE 1 # 03	6,408.71	7,626.37
						WITHOUT LATRINE	PROTOTYPE 1 # 04	5,464.53	6,502.79
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	WITH LATRINE	PROTOTYPE 1 # 05	5,937.60	7,065.75
						WITHOUT LATRINE	PROTOTYPE 1 # 06	4,993.42	5,942.17
					NOT AVAILABLE	WITH LATRINE	PROTOTYPE 1 # 07	5,501.49	6,546.77
						WITHOUT LATRINE	PROTOTYPE 1 # 08	4,557.31	5,423.20
		LOW RESISTANCE SANDOR CLAY WITHOUT COBBLES s Acceptable soil 0.8 @ 1.2 kg/cm2	REINFORCED	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	WITH LATRINE	PROTOTYPE 1 # 09	7,102.45	8,451.92
						WITHOUT LATRINE	PROTOTYPE 1 # 10	6,158.27	7,328.34
					NOT AVAILABLE	WITH LATRINE	PROTOTYPE 1 # 11	6,666.34	7,932.95
						WITHOUT LATRINE	PROTOTYPE 1 # 12	5,722.16	6,809.37
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	WITH LATRINE	PROTOTYPE 1 # 13	6,195.23	7,372.32
						WITHOUT LATRINE	PROTOTYPE 1 # 14	5,251.05	6,248.75
					NOT AVAILABLE	WITH LATRINE	PROTOTYPE 1 # 15	5,759.12	6,853.35
						WITHOUT LATRINE	PROTOTYPE 1 # 16	4,814.94	5,729.78

JOSE ALBERTO AGERO MARTINEZ
INGENIERO CIVIL
Reg. del Colegio de Ingenieros Nº 80207

CONSTRUCTION AREA		KIND OF SOIL / FOUNDATION		KIND OF ROOF	ELECTRICAL INSTALLATIONS	KIND OF SANITARY INSTALLATIONS	CODIFICATION	COST S/.	COST S/. INCL. IGV
		CHARACTERISTICS	FOOTING						
PROTOTYPE 2 BFH 13400	AREA 35.47 m2	REGULAR RESISTANCE GRANULAR MATERIAL WITH COBBLES OF SMALL TO BIG STONES σ Acceptable soil 1.2 @ Mas kg/cm2	SIMPLE	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	BATHROOM	PROTOTYPE 2 # 01	13,727.94	16,336.25
						LATRINE	PROTOTYPE 2 # 02	12,958.89	15,421.08
					NOT AVAILABLE	BATHROOM	PROTOTYPE 2 # 03	13,058.15	15,539.20
						LATRINE	PROTOTYPE 2 # 04	12,330.30	14,673.06
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	BATHROOM	PROTOTYPE 2 # 05	11,876.87	14,133.47
						LATRINE	PROTOTYPE 2 # 06	11,084.98	13,191.13
					NOT AVAILABLE	BATHROOM	PROTOTYPE 2 # 07	11,207.07	13,336.41
						LATRINE	PROTOTYPE 2 # 08	10,456.39	12,443.11
		LOW RESISTANCE SAND OR CLAY WITHOUT COBBLES σ Acceptable soil 0.8 @ 1.2 kg/cm2	REINFORCED	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	BATHROOM	PROTOTYPE 2 # 09	14,238.98	16,944.39
						LATRINE	PROTOTYPE 2 # 10	13,436.78	15,989.77
					NOT AVAILABLE	BATHROOM	PROTOTYPE 2 # 11	13,569.19	16,147.33
						LATRINE	PROTOTYPE 2 # 12	12,808.19	15,241.75
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	BATHROOM	PROTOTYPE 2 # 13	12,387.90	14,741.60
						LATRINE	PROTOTYPE 2 # 14	11,562.87	13,759.81
					NOT AVAILABLE	BATHROOM	PROTOTYPE 2 # 15	11,718.11	13,944.55
						LATRINE	PROTOTYPE 2 # 16	10,934.28	13,011.79

JOSE ALBERTO AGERO MARTINEZ
INGENIERO CIVIL
Reg. del Colegio de Ingenieros Nº 80207

CONSTRUCTION AREA		KIND OF SOIL / FOUNDATION		KIND OF ROOF	ELECTRICAL INSTALLATIONS	KIND OF SANITARY INSTALLATIONS	CODIFICATION	COST S/.	COST S/. INCL. IGV
		CHARACTERISTICS	FOOTING						
PROTOTYPE 3 BONUS BFH 16400	AREA 43.23 m2	REGUAR RESISTANCE GRANULAR MATERIAL WITH COBBLES OF SMALL TO BIG STONES σ acceptable soil 1.2 @ Mas kg/cm2	SIMPLE	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	BATHROOM	PROTOTYPE 3 #01	17,371.36	20,671.91
						LATRINE	PROTOTYPE 3 #02	16,454.80	19,581.21
					NOT AVAILABLE	BATHROOM	PROTOTYPE 3 #03	16,611.29	19,767.43
						LATRINE	PROTOTYPE 3 #04	15,730.17	18,718.90
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	BATHROOM	PROTOTYPE 3 #05	14,591.30	17,363.64
						LATRINE	PROTOTYPE 3 #06	13,796.21	16,417.49
					NOT AVAILABLE	BATHROOM	PROTOTYPE 3 #07	13,831.23	16,459.16
						LATRINE	PROTOTYPE 3 #08	13,071.58	15,555.18
		LOW RESISTANCE SAND OR CLAY WITHOUT COBBLES σ acceptable soil 0.8 @ 1.2 kg/cm2	REINFORCED	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	BATHROOM	PROTOTYPE 3 #09	18,014.27	21,436.99
						LATRINE	PROTOTYPE 3 #10	17,042.89	20,281.04
					NOT AVAILABLE	BATHROOM	PROTOTYPE 3 #11	17,254.20	20,532.50
						LATRINE	PROTOTYPE 3 #12	16,318.26	19,418.74
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	BATHROOM	PROTOTYPE 3 #13	15,234.22	18,128.72
						LATRINE	PROTOTYPE 3 #14	14,384.31	17,117.32
					NOT AVAILABLE	BATHROOM	PROTOTYPE 3 #15	14,474.15	17,224.23
						LATRINE	PROTOTYPE 3 #16	13,659.68	16,255.02

JOSE ALBERTO AGERO MARTINEZ
INGENIERO CIVIL
Reg. del Colegio de Ingenieros Nº 80207

CONSTRUCTION AREA		KIND OF SOIL / FOUNDATION		KIND OF ROOF	ELECTRICAL INSTALLATIONS	KIND OF SANITARY INSTALLATIONS	CODIFICATION	COST S/.	COST S/. INCL. IGV
		CHARACTERISTICS	FOOTING						
PROTOTYPE 4 BONUS 6000 + 13400	AREA 53.13 m2	REGULAR RESISTANCE GRANULAR MATERIAL WITH COBBLES OF SMALL TO BIG STONES σ Acceptable soil 1.2 @ Mas kg/cm2	SIMPLE	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	BATHROOM	PROTOTYPE 4 # 01	19,300.73	22,967.87
						LATRINE	PROTOTYPE 4 # 02	18,391.78	21,886.22
					NOT AVAILABLE	BATHROOM	PROTOTYPE 4 # 03	18,387.87	21,881.56
						LATRINE	PROTOTYPE 4 # 04	17,520.13	20,848.95
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	BATHROOM	PROTOTYPE 4 # 05	16,670.86	19,838.33
						LATRINE	PROTOTYPE 4 # 06	15,799.02	18,800.83
					NOT AVAILABLE	BATHROOM	PROTOTYPE 4 # 07	15,758.00	18,752.02
						LATRINE	PROTOTYPE 4 # 08	14,927.36	17,763.56
		LOW RESISTANCE SAND OR CLAY WITHOUT COBBLES σ Acceptable soil 0.8 @ 1.2 kg/cm2	REINFORCED	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	BATHROOM	PROTOTYPE 4 # 09	20,042.38	23,850.43
						LATRINE	PROTOTYPE 4 # 10	19,078.61	22,703.55
					NOT AVAILABLE	BATHROOM	PROTOTYPE 4 # 11	19,129.52	22,764.12
						LATRINE	PROTOTYPE 4 # 12	18,206.95	21,666.27
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	BATHROOM	PROTOTYPE 4 # 13	17,412.51	20,720.89
						LATRINE	PROTOTYPE 4 # 14	16,485.84	19,618.15
					NOT AVAILABLE	BATHROOM	PROTOTYPE 4 # 15	16,499.65	19,634.58
						LATRINE	PROTOTYPE 4 # 16	15,614.19	18,580.88

JOSE ALBERTO AGERO MARTINEZ
INGENIERO CIVIL
Reg. del Colegio de Ingenieros Nº 80207

DESCRIPTIVE REPORT OF ELECTRICAL INSTALLATIONS

PROJECT:

"PROVISION OF THE RECONSTRUCTION OF SAFER HOUSING" STUDY OF RECONSTRUCTION OF SEISMIC-RESISTANT HOUSING IN THE REPUBLIC OF PERU

REGION : ICA

PROVINCE : ICA

DISTRICTS : PUEBLO NUEVO, INDEPENDENCIA, LATINGUIÑA

This Project includes:

- Interior Electrical installations of 4 prototypes of projected housing.
- Board of voltage and one-wire diagram according to the kind of house.
- Design of the lighting and outlets in bedrooms, living room, dinning room, kitchen depending of the house prototype.

1.0 GENERALITIES

This study corresponds to the definitive project of electrical installations for the construction of 4 prototypes of houses

Legal Basis:

- Municipalities Regulations
- Electrical Concession Regulations # 25844 and its rules
- National Code of Electricity – Use
- National Regulation of Construction

For the design of the abovementioned systems it was considered the following items:

2.0 ARCHITECTURAL APPROACH

It was considered the 4 proposed prototypes of houses, where was considered the distribution of each prototype:

The described rooms in each prototype could be appreciated in the architecture drawings

Carlos Armando Cantu Pajuelo
INGENIERO ELECTRICISTA
Reg. del Colegio de Ingenieros N° 56624

3.0 SCOPES

The electrical installations include the following items:

- Installation of electro-duct of power supply from the point determined for the location of the energy measuring device by the concessionaire, to the general board located in the main bedroom of each prototype of the house. From this board the derivative circuits of lighting and outlet are controlled.

3.1 INSTALLED VOLTAGE

The Installed Voltage and Peak Load have been determined according to the constructed net area. The voltages were detailed in the pertinent drawings.

Item	Installed Charge (I.Ch) KW.	Peak Load (P.L.) KW.
Prototype 1	0.39	0.39
Prototype 2	0.88	0.88
Prototype 3	1.03	1.03
Prototype 4	1.28	1.28

4.0 DESCRIPTION OF THE PROJECT

4.1 ELECTRICAL SUPPLY

The electrical supply for all the prototypes of houses will be: 220 V - 1ø - 60 Hz. This power supply will be performed by the concessionaire of the locality.

4.2 PARTS COMPRISING THE ELECTRICAL INSTALLATIONS

a.- ELECTRICAL CIRCUITS

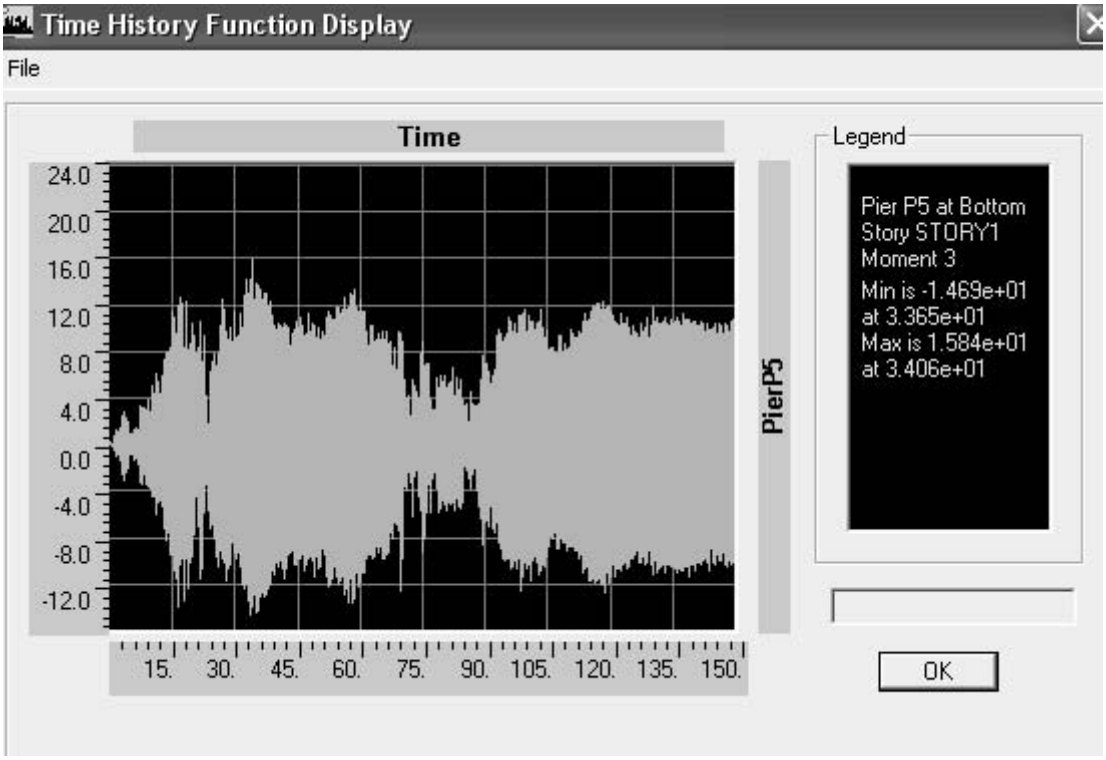
a.1) Lighting Circuit

It has been projected a lighting circuit from the general board depending of the kind of prototype of houses.
The electrical appliances will be controlled by simple and commutation switches that are located according to the area.

a.2) Outlet Circuit

It has been projected considering the supply from the board to each outlet giving continuity to the circuit by a connection in the box of the same outlet.
It has been considered that all the outlets have ground connection.

The response of the moment in the first floor is 15.84 Tn·m



The shear capacity of the wall (VR) can be checked according to the E.070 code, not taking into account the axial load, we obtain a resistant shear of the most critic wall critic, calculating with the following data we obtain:

v´m= 5.1 kg/cm2 (handcrafted brick)
L=315 cm
t=13 cm

$$VR = 0.5 \cdot v'm \cdot L \cdot t$$

VR= 0.5·(5.1)·(315)·(13)
VR=10442 kg
VR=10.44 Tn, value greater than 6.135 Tn OK

DESCRIPTIVE REPORT OF SANITARY INSTALLATIONS

PROJECT:

"PROVISION OF THE RECONSTRUCTION OF SAFER HOUSING" STUDY OF RECONSTRUCTION OF SEISMIC-RESISTANT HOUSING IN THE REPUBLIC OF PERU

REGIÓN	**:**	**ICA**
PROVINCE	**:**	**ICA**
DISTRICTS	**:**	**PUEBLO NUEVO, INDEPENDENCIA, LATINGUIÑA**

1.0 GENERAL ASPECTS

This Project is performed to provide potable water and sewage service to the different areas that composed the construction of the different prototypes of safer housing for the Districts of Pueblo Nuevo, Independencia and La Tinguiña, located at the Province of Chincha, Pisco and Ica respectively.

2.0 COLD WATER

The cold water system has been projected according to the regulations set forth at the Title III of the National Regulations of Construction (RM 290-2005 Housing) Technical Standard I.S.010.

The water supply system for domestic use has been selected taking into consideration the pressure of the public system and the easy steps for maintenance.

2.1 Quantity of required water

The cold water quantity includes:

Daily consumption:

Average population = 5.00 person/house

Quantity = 150 lt/person/day (according to RNC)

Total of daily consumption = 750 lt7day

2.2 Distribution systems

The pipe lines used for the water distribution for domestic consumption will be of PVC Class 10 S.P. f/cold water with diameter of ½".

The distribution systems include from the installation of the measuring device to each consumption points. The supply and distribution systems have shutoff valves, elbows, T, reductions, etc. which will guarantee their quality, quantity and pressure of the service at the consumption point.

The distribution of the Cold Water installations could be observed at the Plans of IS Denomination.

3.0 DRAINAGE AND VENTILATION SYSTEM

The drainage systems have been design for the sewage water could be evacuated quickly from all the collection points to the discharge place and final evacuation. The sewage will discharge by gravity from each evacuation point to finally discharge to a Final Registration Box.

The sewage distribution system are showed at the Plans of IS Denomination.
The gradients will be according to the pipe diameter, in pipes system major and equal to 4" the gradient will be of 1% and in the pipes minor and equal of 3" the gradient will not be minor of 1.5%.

The sewage piping line will be of PVC Class SAL for/sewage of 2" and 4". The sewage system has sufficient elements of registry to facilitate their easily and quickly maintenance and cleaning.

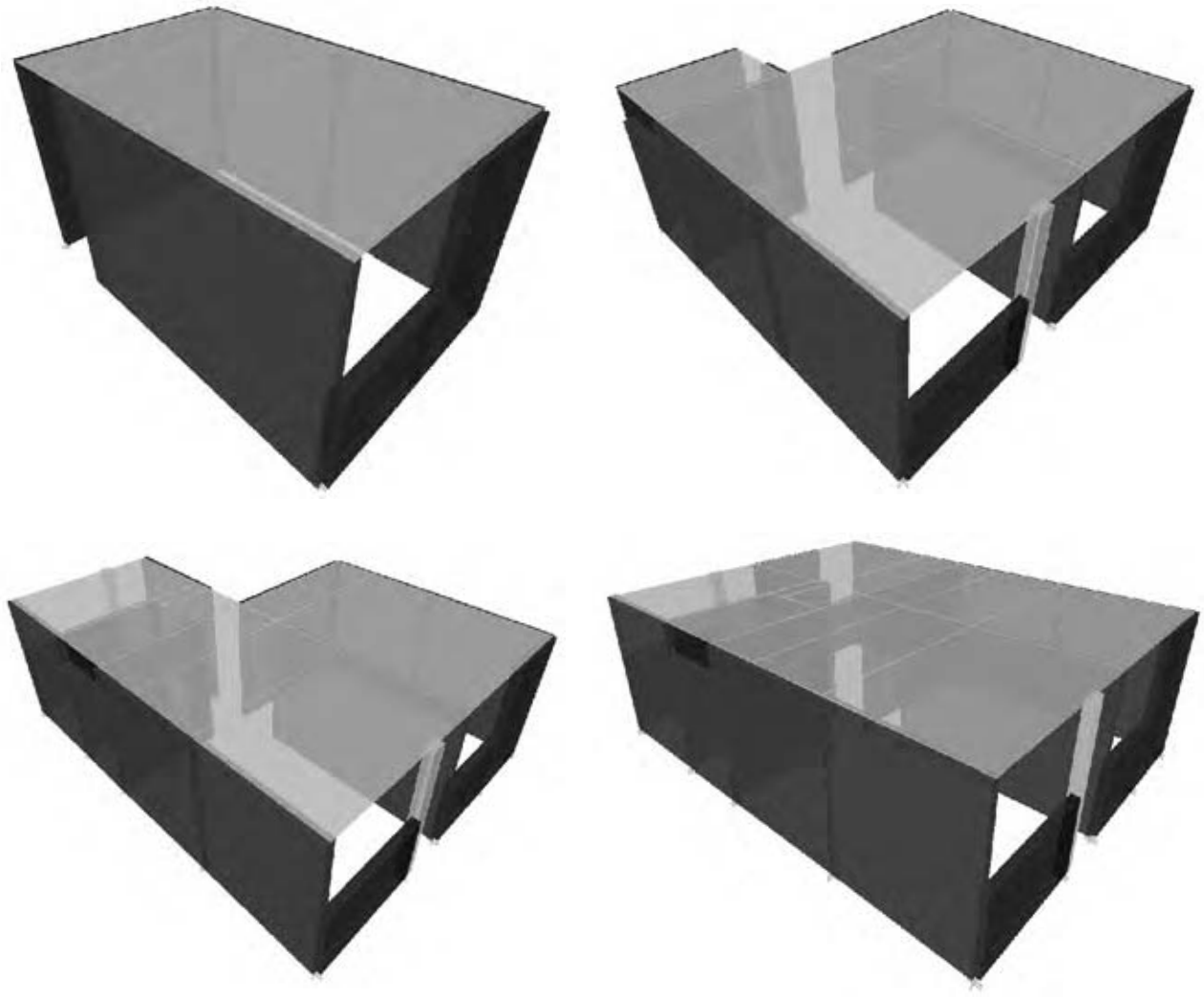
Also it is placed ventilation points distributed to obstruct the formation of empties or elevation of pressure which could discharge the traps.

The ventilation pipes which reach the external area is elevated 0.30 m. above the level of the roof with their hubcap.

The ventilation piping will be of PVC Class SAL for/sewage of 2".

3.0 ADAPTING TO THE TECHNICAL STANDARDS

At construction moment it is necessary to considerate that all material and equipment to be installed and also the installation works (excavations, piping laying etc.) will be performed according to the standards in force. The use of material and installation manner which are not included in this project must fulfill all the requirements and standards of the Title X of the National Regulation of Construction.



MEMORY OF CALCULATE: SEISMIC ANALYSIS OF PROTOTYPES

PROJECT:

"PROVISION OF THE RECONSTRUCTION OF SAFER HOUSING" – RECONSTRUCTION STUDY OF SEISMIC RESISTANT HOUSING IN THE REPUBLIC OF PERU

REGION : ICA
PROVINCE : ICA
DISTRICTS : PUEBLO NUEVO, INDEPENDENCIA, LA TINGUIÑA

Lima 2008

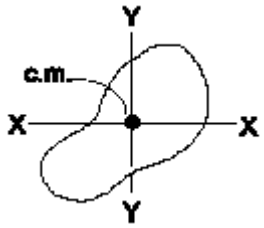
JOSÉ ALBERTO CERRO MARTÍNEZ
INGENIERO CIVIL
Reg. del Colegio de Ingenieros Nº 82207

1. Introduction

Structural model were performed for the 4 prototypes to analize the seismic analysis, in the ETABSv8.6.2. program

2. Masas (M) and masic inertial moment (MMIcm)

Having an average weight per floor per area of 0.70 tn/m2, the masses (M) and the **masses inertial moment** (J) were distributed, according to the following expression, and that computationally the ETABS program considers.

	**General Diaphragm** **total Mass M=W/g** *A = Area of the diaphragm* *Ix, Iy = inertia moment of area around the axis of the x and y, respectively.*	MMIcm=$\frac{M(Ix+Iy)}{A}$

3. Response Spectrum introduced to the models

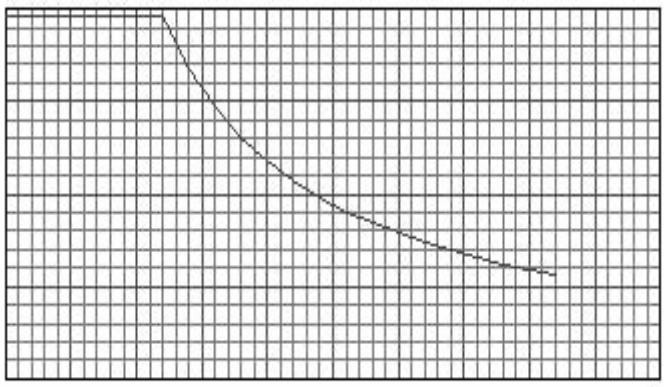
The response spectrum was introduced in the directions "x" and "y", with the following seismic parameters:

Z=0.4 (Zone Factor)
S=1.2 (Soil Factor)
U=1.0 (Use Factor)
Tp=0.60 seg.(period of the plataform)
R=3 (Reduction Factor)
g = gravity
Sa = Pseudo-acceleration response spectrum

The reduced response spectrum is:

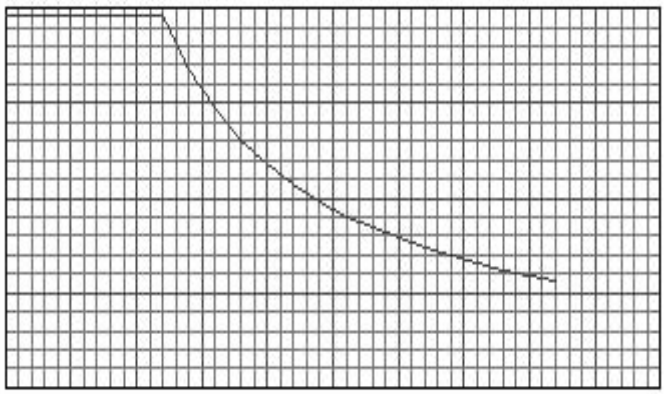
$$Sa = \frac{Z \cdot U \cdot C \cdot S}{R} \cdot g$$

Period	Acceleration
1.000E-04	3.924
0.1	3.924
0.2	3.924
0.3	3.924
0.4	3.924
0.45	3.924
0.5	3.924
0.55	3.924



Reduced spectrum considering Rx=3

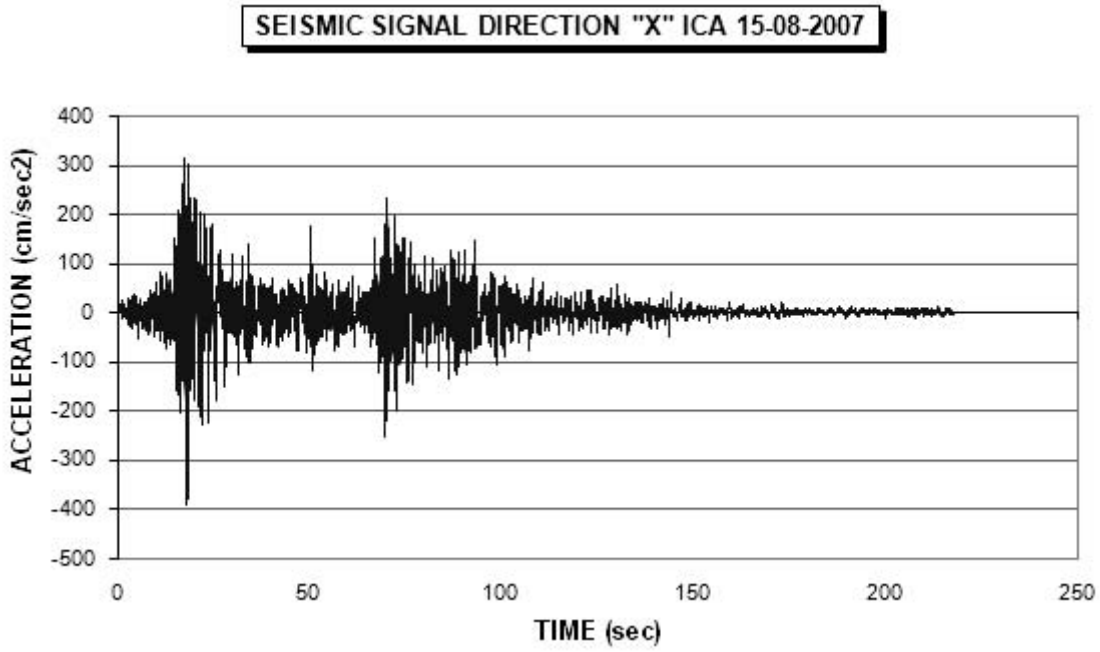
Period	Acceleration
1.000E-04	3.924
0.1	3.924
0.2	3.924
0.3	3.924
0.4	3.924
0.45	3.924
0.5	3.924
0.55	3.924

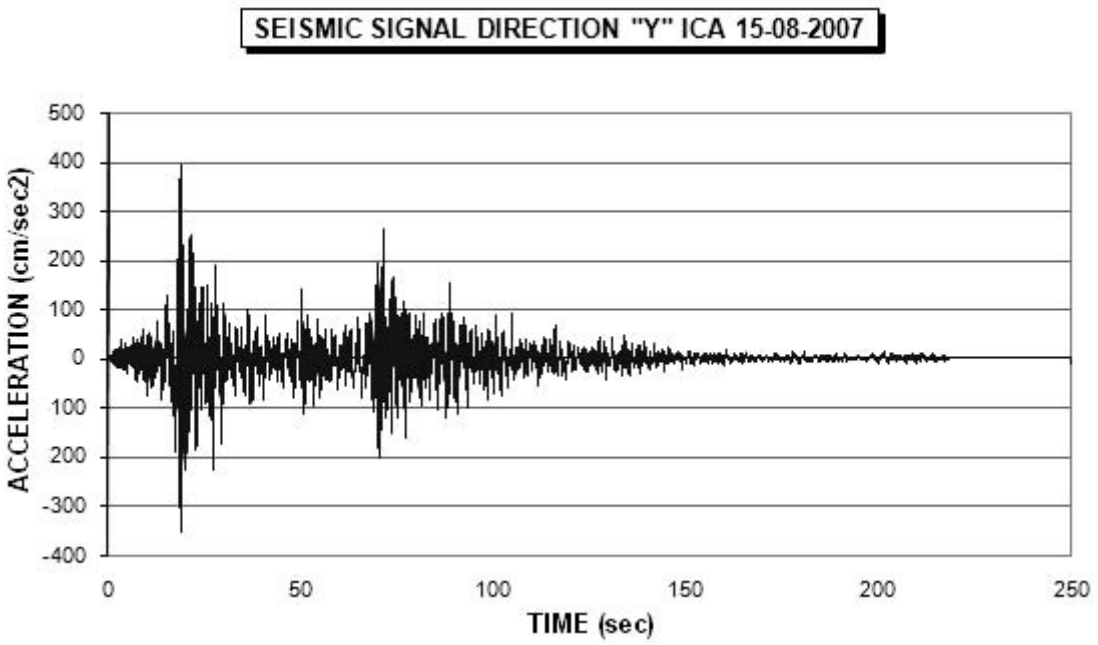


Reduced spectrum considering Ry=3

4. Seismic signal introduced to the models

Also, the seismic signals of Ica of the 15 of August of 2007 have been applied to the model, this signal was scaled to an acceleration of 0.4g = 0.4 (981cm/s2) = 392.4cm/s2, the accelerations are shown in the following Figures.





5. Periods of vibration and factors mass participation

The periods of vibration and factors mass participation calculated with the ETABS, are the following:

Periods and factors mass participation (ETABS)

Prototype 1

Mode	Period	UX	UY	SumUX	SumUY
1	0.0532	98.7010	0.0001	98.7010	0.0001
2	0.0420	0.4709	62.7746	99.1718	62.7747
3	0.0334	0.8282	37.2253	100	100

Prototype 2

Mode	Period	UX	UY	SumUX	SumUY
1	0.0604	95.9680	0.0955	95.9680	0.0955
2	0.0409	0.0030	98.3741	95.9710	98.4697
3	0.0344	4.0290	1.5303	100	100

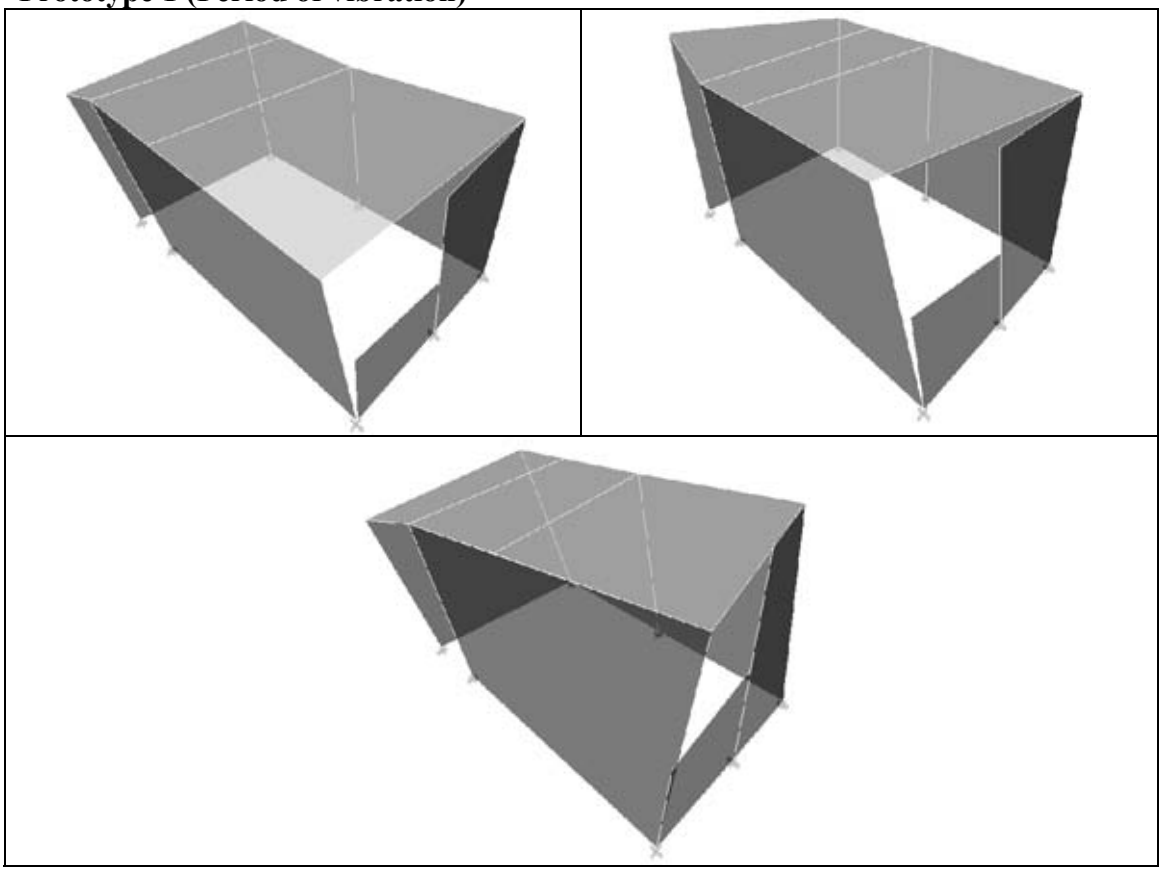
Prototype 3

Mode	Period	UX	UY	SumUX	SumUY
1	0.0622	98.7442	0.0252	98.7442	0.0252
2	0.0420	0.8238	48.2384	99.5681	48.2635
3	0.0395	0.4319	51.7365	100	100

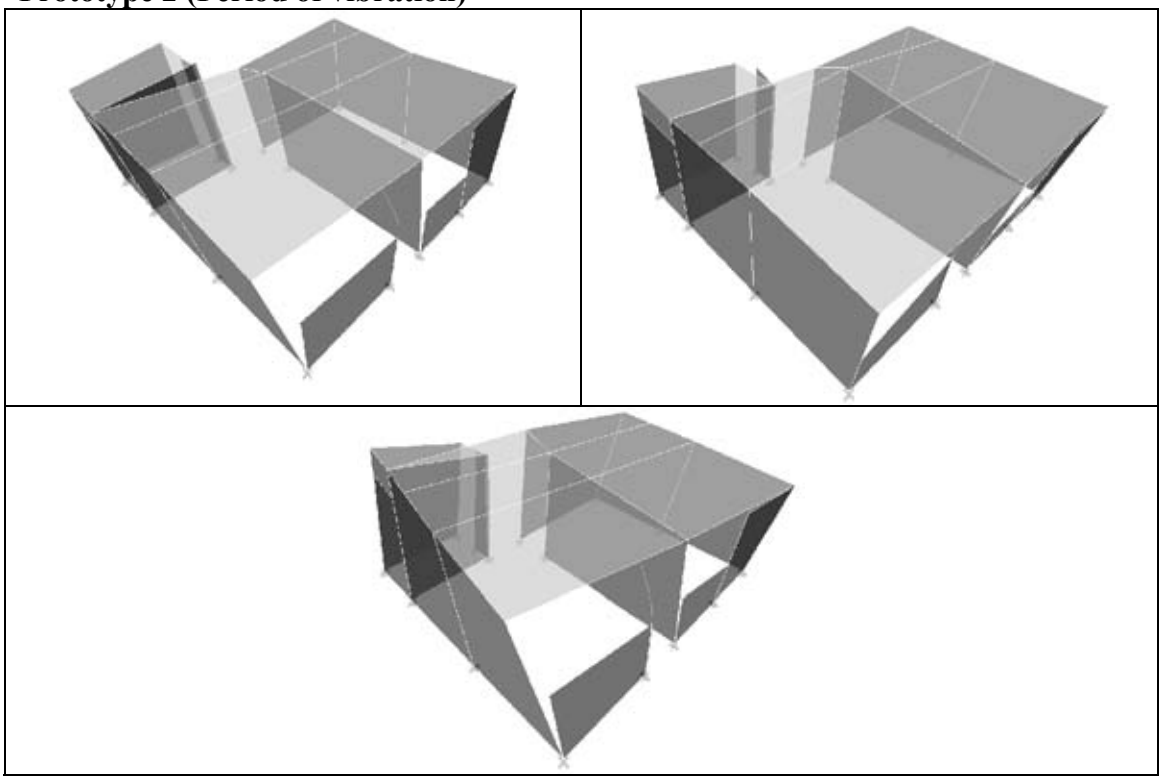
Prototype 4

Mode	Period	UX	UY	SumUX	SumUY
1	0.0610	97.5618	0.3595	97.5618	0.3595
2	0.0404	0.0129	79.8093	97.5746	80.1688
3	0.0398	2.4254	19.8312	100	100

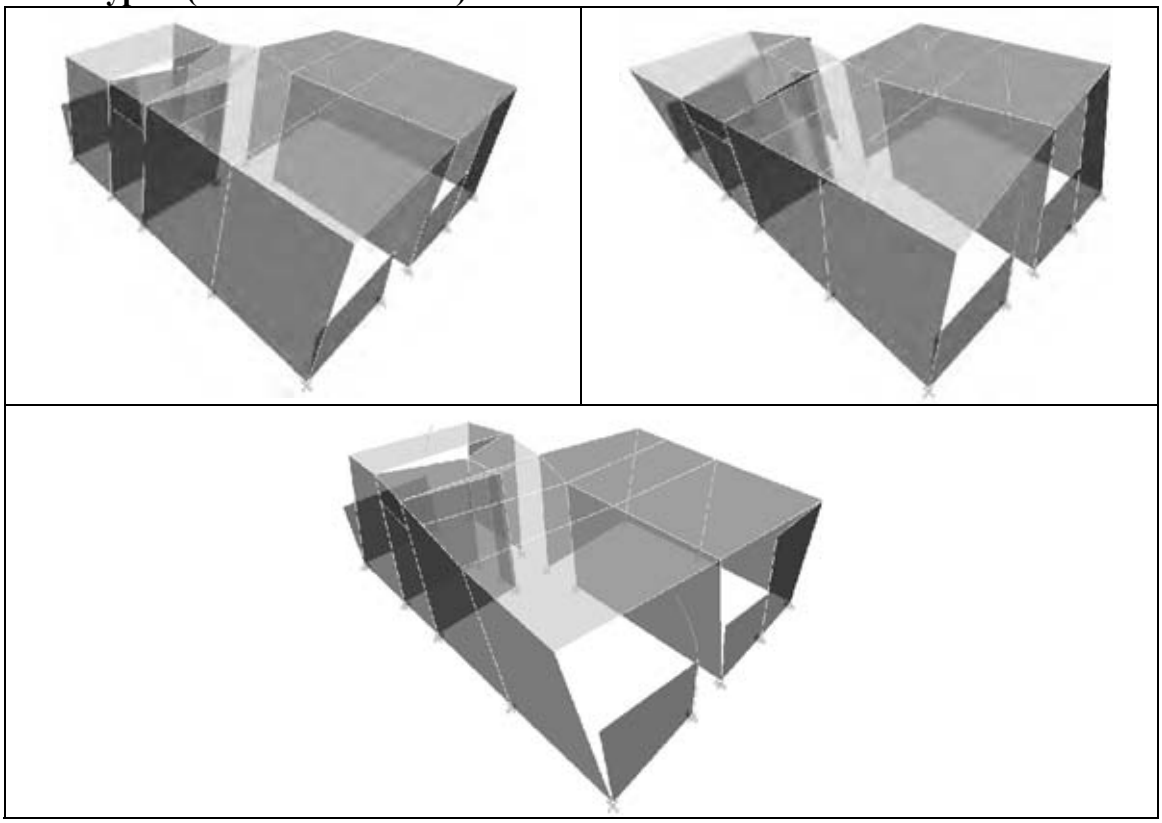
Prototype 1 (Period of vibration)



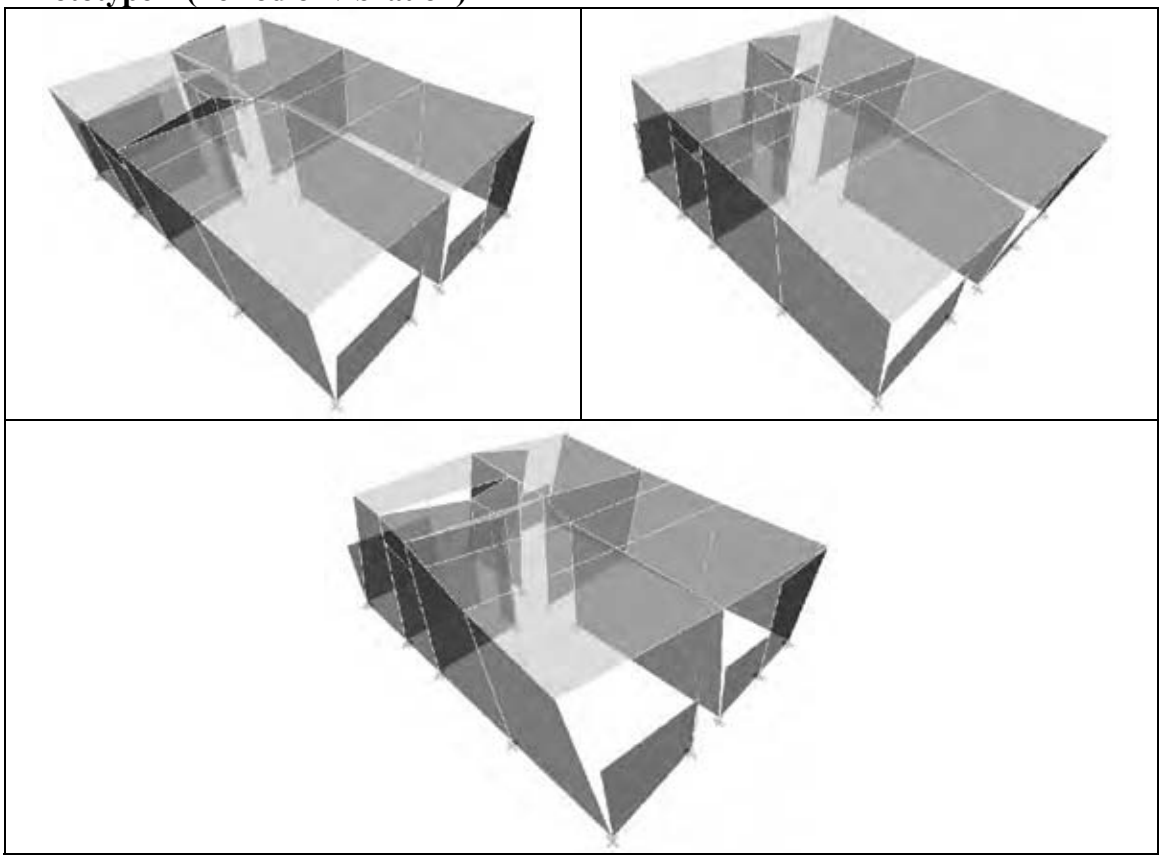
Prototype 2 (Period of vibration)



Prototype 3 (Period of vibration)



Prototype 4 (Period of vibration)



6. Check of drift and structural regularity

It was checked in respect o the center of masses and in respect to two opposite points.

Displacement in X in millimeter, drift and control of spins (Prototype 1)

		Displacements in X			Drift			Spins	
Level	hi(m)	CM	Extr.1	Extr.2	0.75·R·(di-do)/h<0.005			Extr.1	Extr.2
1º	2.75	0.27830	0.24770	0.31040	0.00023	0.00020	0.00025	0.89005	1.11534

Displacement in X in millimeter, drift and control of spins (Prototype 2)

		Displacements in X			Drift			Spins	
Level	hi(m)	CM	Extr.1	Extr.2	0.75·R·(di-do)/h<0.005			Extr.1	Extr.2
1º	2.75	0.34850	0.27160	0.41440	0.00029	0.00022	0.00034	0.77934	1.18910

Displacement in X in millimeter, drift and control of spins (Prototype 3)

		Displacements in X			Drift			Spins	
Level	hi(m)	CM	Extr.1	Extr.2	0.75·R·(di-do)/h<0.005			Extr.1	Extr.2
1º	2.75	0.37950	0.32310	0.42500	0.00031	0.00026	0.00035	0.85138	1.11989

Displacement in X in millimeter, drift and control of spins (Prototype 4)

		Displacements in X			Drift			Spins	
Level	hi(m)	CM	Extr.1	Extr.2	0.75·R·(di-do)/h<0.005			Extr.1	Extr.2
1º	2.75	0.36130	0.30300	0.42420	0.00030	0.00025	0.00035	0.83864	1.17409

Displacement in Y in millimeter, drift and control of spins (Prototype 1)

		Displacements in Y			Drift			Spins	
Level	hi(m)	CM	Extr.1	Extr.2	0.75·R·(di-do)/h<0.005			Extr.1	Extr.2
1º	2.75	0.12350	0.16110	0.10120	0.00010	0.00013	0.00008	1.30445	0.81943

Displacement in Y in millimeter, drift and control of spins (Prototype 2)

		Displacements in Y			Drift			Spins	
Level	hi(m)	CM	Extr.1	Extr.2	0.75·R·(di-do)/h<0.005			Extr.1	Extr.2
1º	2.75	0.16390	0.14790	0.18320	0.00013	0.00012	0.00015	0.90238	1.11775

Displacement in Y in millimeter, drift and control of spins (Prototype 3)

		Displacements in Y			Drift			Spins	
Level	hi(m)	CM	Extr.1	Extr.2	0.75·R·(di-do)/h<0.005			Extr.1	Extr.2
1º	2.75	0.15280	0.15310	0.17560	0.00013	0.00013	0.00014	1.00196	1.14921

Displacement in Y in millimeter, drift and control of spins (Prototype 4)

		Displacements in Y			Drift			Spins	
Level	hi(m)	CM	Extr.1	Extr.2	0.75·R·(di-do)/h<0.005			Extr.1	Extr.2
1º	2.75	0.16050	0.15740	0.16460	0.00013	0.00013	0.00013	0.98069	1.02555

It is observed that at not any case it overcomes the drift to the E.030 code, and the housing is a structure regular.

7. Seismic Summary

According to what was observed, the displacements to both direction does not overcome the normative limits, and now we will see the relation between static shear and dynamic, such as it is shown in the following table:

Comparison of Base Shear (Prototype 1)

Dynamics Characteristics	ETABS	
	X	Y
T (seg.)	0.0532	0.0420
F. PARTIC. (%)	98.701	62.7746
V Spectral	**4.24**	**3.34**
C	2.50	2.50
V Static	**4.29**	**4.29**
V Time History	**3.78**	**3.07**

Comparison of Base Shear (Prototype 2)

Dynamics Characteristics	ETABS	
	X	Y
T (seg.)	0.0604	0.0409
F. PARTIC. (%)	95.968	98.3741
V Spectral	**8.55**	**8.78**
C	2.50	2.50
V Static	**8.89**	**8.89**
V Time History	**8.05**	**5.74**

Comparison of Base Shear (Prototype 3)

Dynamics Characteristics	ETABS	
	X	Y
T (seg.)	0.0622	0.0420
F. PARTIC. (%)	98.7442	48.2384
V Spectral	**10.8**	**10.14**
C	2.50	2.50
V Static	**10.93**	**10.93**
V Time History	**12.56**	**7.30**

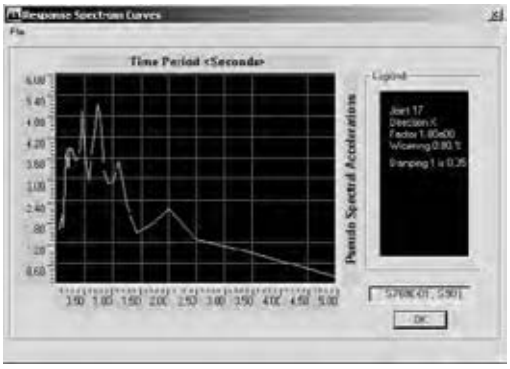
Comparison of Base Shear (Prototype 4)

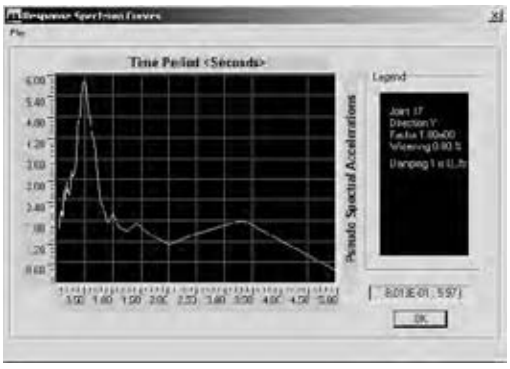
Dynamics Characteristics	ETABS	
	X	Y
T (seg.)	0.0610	0.0404
F. PARTIC. (%)	97.5618	79.8093
V Spectral	**13.1**	**13.31**
C	2.50	2.50
V Static	**13.41**	**13.41**
V Time History	**9.09**	**9.99**

It can be observed that the prototype 3, has values in Time History greater than the spectrals, therefore it has maximum internal forces. It is mainly due to the period of the structure is located in the maximum values of the response spectrum.

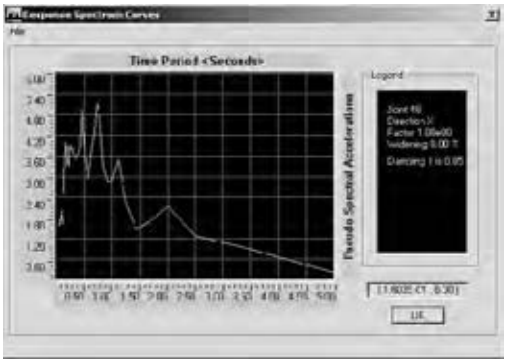
8. Response Spectrum of the prototypes

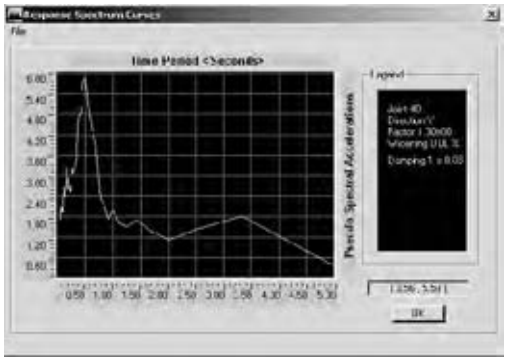
Prototype 1



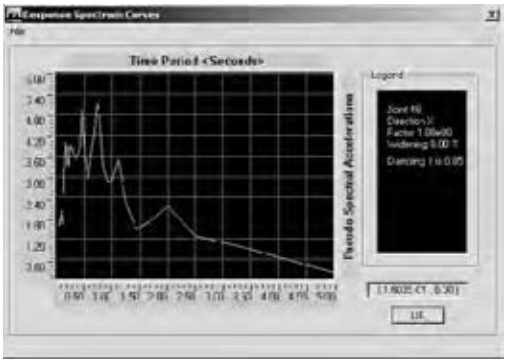


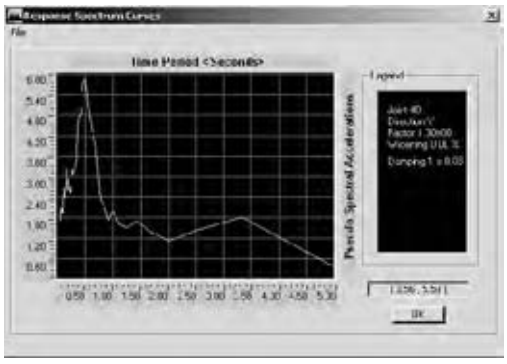
Prototype 2



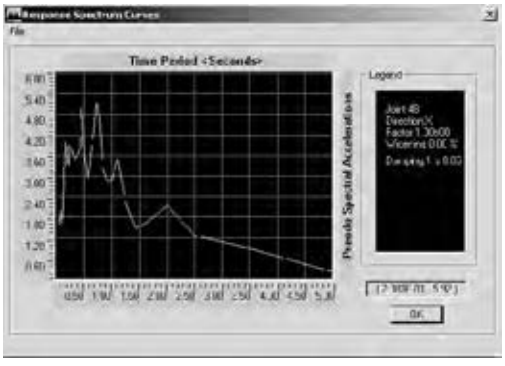


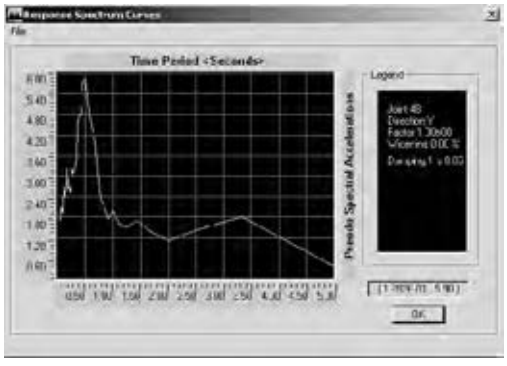
Prototype 3





Prototype 4





It is shown that the spectra in the base of the housing are the same.

JOSÉ ALBERTO CERO MARTÍNEZ
INGENIERO CIVIL
Reg. del Colegio de Ingenieros Nº 80207

9. Internal Forces of the elements

Below it is shown the internal forces of the elements, the response spectrum

PROTOTYPE 1

Wall	Pcm	Pcv	Psx	Psy	VXsx	VXsy	MYsx	MYsy
1	4.660	1.280	0.530	0.620	0.370	1.900	0.350	4.080
2	1.050	0.140	0.980	0.350	1.920	0.530	1.140	0.310
3	2.640	0.550	0.840	0.480	0.570	0.920	1.060	1.410
4	2.650	0.550	1.010	0.560	0.230	0.930	0.640	1.420
5	2.570	0.320	0.880	0.460	2.150	0.900	4.590	1.930

PROTOTYPE 2

Wall	Pcm	Pcv	Psx	Psy	VXsx	VXsy	MYsx	MYsy
1	7.050	2.600	0.630	0.490	0.220	1.840	0.590	4.140
2	0.980	0.150	1.420	0.590	2.610	0.340	1.560	0.410
3	2.590	0.530	0.990	0.610	1.120	1.710	1.860	2.590
4	2.550	0.500	1.370	0.560	0.280	1.730	0.750	2.600
5	3.010	0.540	0.950	0.640	2.560	0.450	5.600	0.950
6	2.600	0.730	0.560	0.960	0.740	1.270	0.820	1.770
7	2.650	0.650	1.290	0.510	0.820	2.000	0.920	2.060
8	1.150	0.200	1.340	0.440	0.330	0.690	0.430	0.820
9	1.660	0.220	0.510	0.560	0.980	0.210	2.200	0.190
10	0.480	0.070	0.560	0.100	0.100	0.030	0.150	0.050
11	1.910	0.360	0.630	0.350	1.800	0.100	3.140	0.580

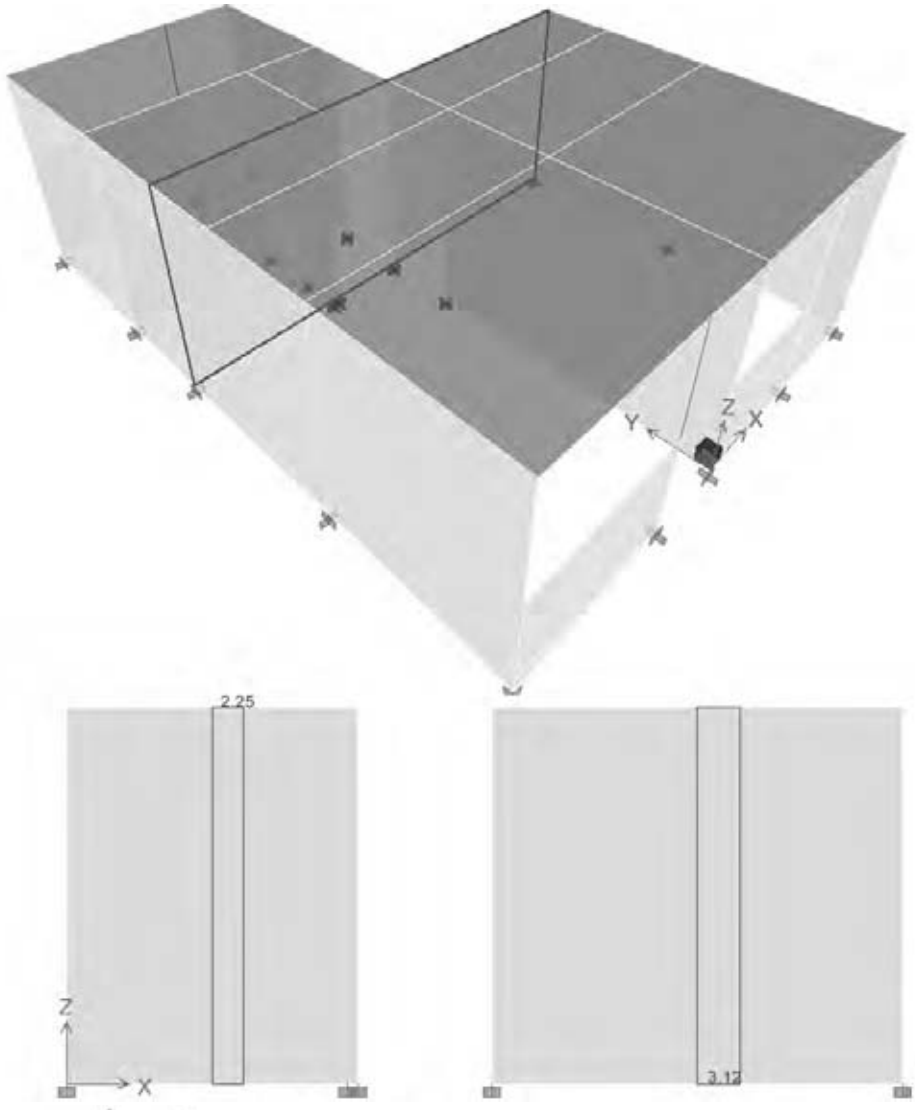
PROTOTYPE 3

Wall	Pcm	Pcv	Psx	Psy	VXsx	VXsy	MYsx	MYsy
1	7.060	2.600	0.600	0.470	0.100	1.720	1.060	3.870
2	0.970	0.150	1.410	0.610	2.650	0.510	1.580	0.430
3	2.580	0.530	1.080	0.570	0.990	1.660	1.700	2.490
4	2.540	0.500	1.560	0.520	0.250	1.670	0.750	2.500
5	**3.140**	**0.600**	**1.230**	**0.640**	**3.120**	**0.520**	**6.750**	**0.950**
6	2.590	0.720	0.230	0.980	0.280	1.330	0.200	1.830
7	2.670	0.650	1.330	0.480	0.230	2.160	0.940	2.140
8	1.270	0.250	1.130	0.140	0.170	0.850	0.190	0.960
9	1.870	0.330	1.300	0.470	1.660	0.280	3.210	0.510
10	0.550	0.110	0.700	0.120	0.130	0.030	0.180	0.050
11	1.860	0.330	1.240	0.640	0.580	1.520	1.110	1.280
12	1.220	0.210	0.120	0.620	0.560	0.180	0.690	0.320
13	2.900	0.700	0.000	0.000	0.060	0.600	0.160	1.640
14	2.040	0.420	0.830	0.410	2.250	0.180	3.860	0.670

It is observed that for the wall P5, it has the great value of shear (3.12 Tn) and therefore the moment is (6.75 tn·m) in the spectral analysis.

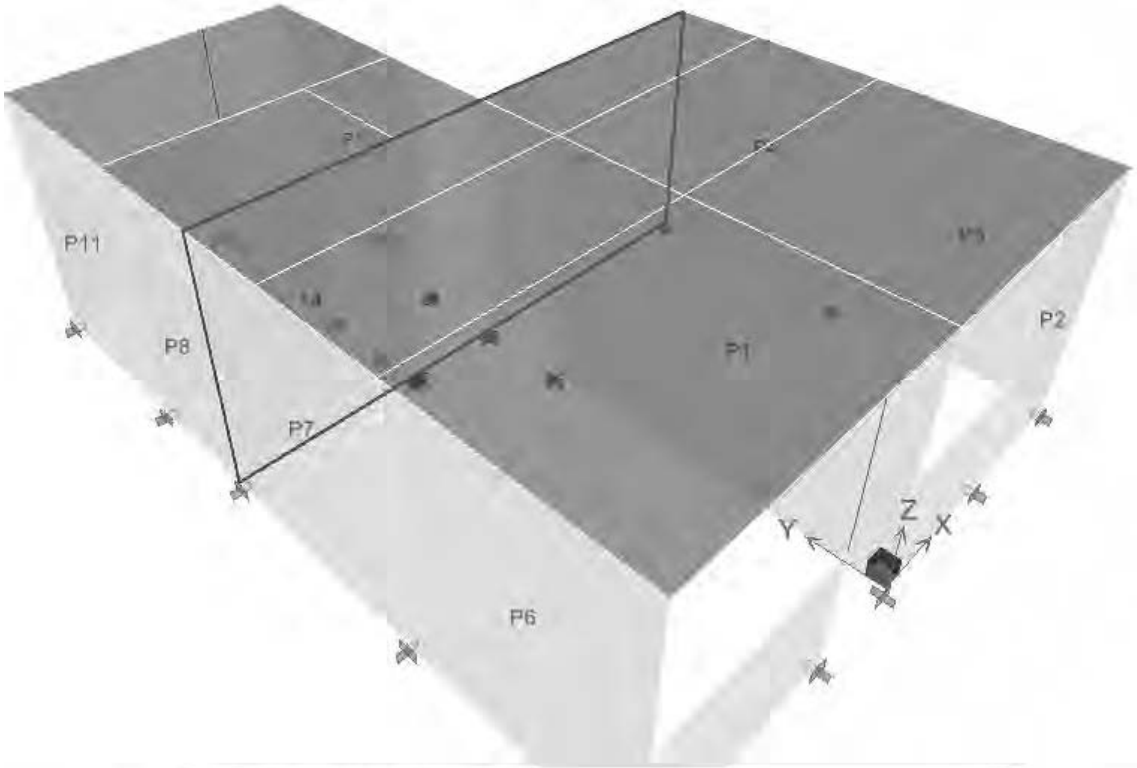
PROTOTYPE 4

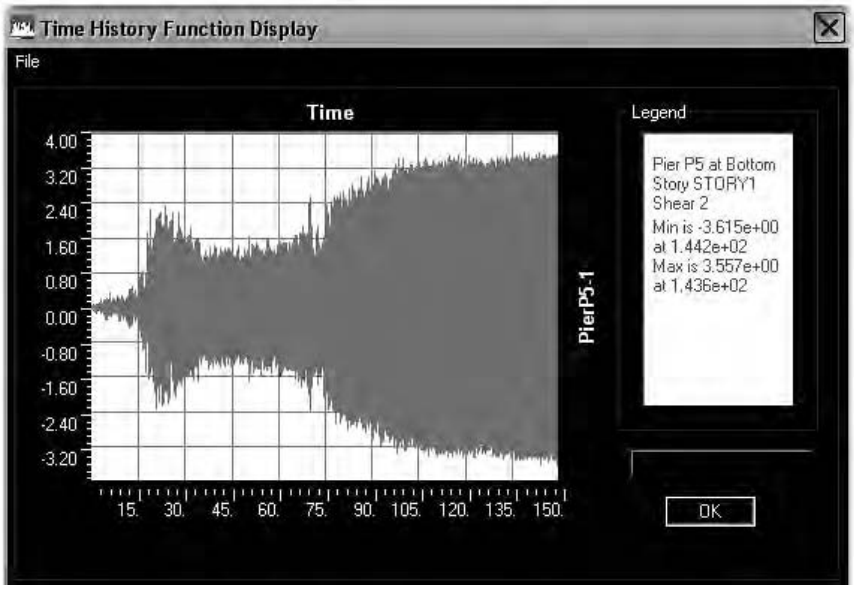
Wall	Pcm	Pcv	Psx	Psy	VXsx	VXsy	MYsx	MYsy
1	7.050	2.600	0.700	0.480	0.410	1.790	0.300	4.020
2	0.960	0.160	1.320	0.510	2.610	0.320	1.540	0.360
3	2.570	0.520	1.200	0.570	0.750	1.560	1.410	2.350
4	2.630	0.550	0.840	0.070	0.130	1.760	0.330	2.440
5	3.650	0.850	1.860	0.130	3.390	0.230	6.540	0.430
6	2.620	0.750	0.500	1.010	0.660	1.360	0.710	1.890
7	2.690	0.650	1.420	0.480	0.830	2.220	0.770	2.200
8	1.300	0.260	1.090	0.070	0.420	0.870	0.470	0.980
9	1.830	0.330	1.220	0.460	1.570	0.120	3.100	0.470
10	0.540	0.100	0.650	0.130	0.120	0.030	0.170	0.060
11	1.850	0.540	1.350	0.640	0.870	1.560	1.180	1.310
12	1.180	0.190	0.300	0.630	0.510	0.080	0.700	0.310
13	4.020	1.250	0.860	0.530	0.390	0.910	1.000	1.880
14	1.700	0.320	0.860	0.530	2.150	0.300	1.610	0.470
15	3.340	0.830	1.880	1.180	0.590	2.130	1.700	3.200
16	2.040	0.400	0.870	0.410	2.160	0.160	3.680	0.710

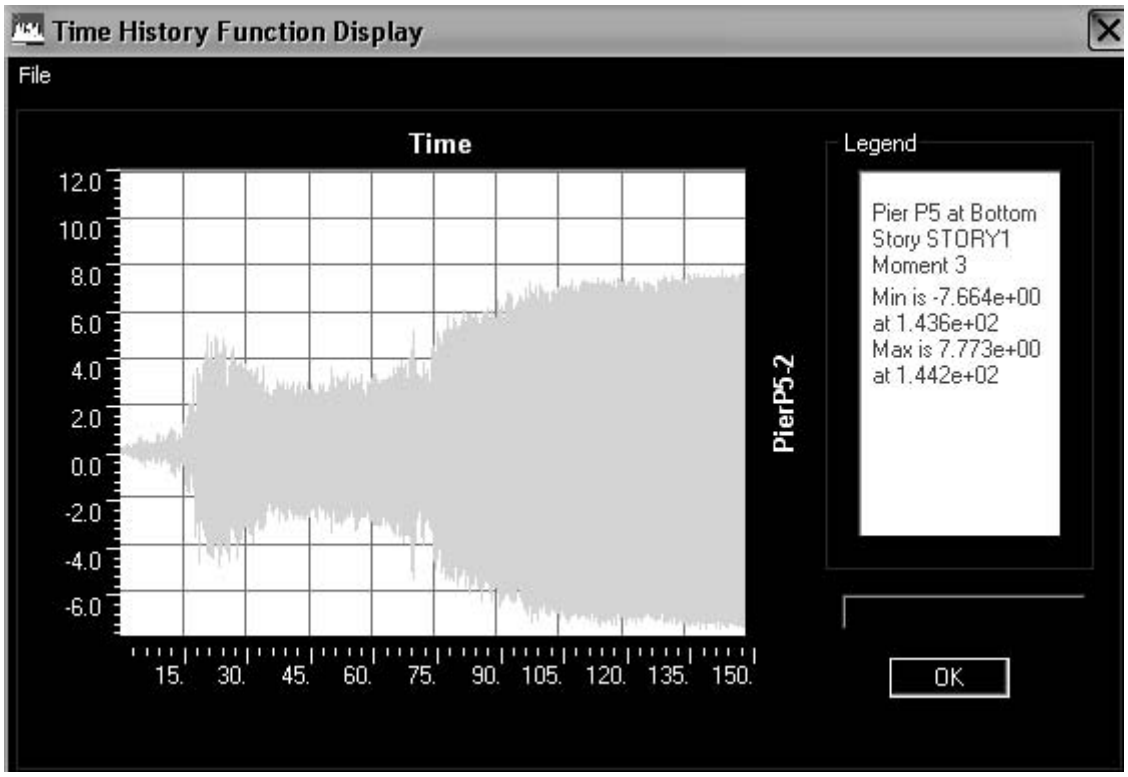


JOSÉ ALBERTO CISNEROS MARTÍNEZ
INGENIERO CIVIL
Reg. del Colegio de Ingenieros Nº 80207

For the Time History Analysis the following values are considered, for shear 3.615Tn, and for moment a value of 7.77 Tn·m, such it is shown below







The shear capacity of the wall (VR) can be checked according to the E.070 code, not taking into account the axial load, we obtain a resistant shear of the most critic wall critic, calculating with the following data we obtain:

v´m= 5.1 kg/cm2 (handcrafted brick)
L=315 cm
t=13 cm

$$VR = 0.5 \cdot v'm \cdot L \cdot t$$

VR= 0.5·(5.1)·(315)·(13)
VR=10442 kg
VR=10.44 Tn, value greater than 3.615 Tn OK

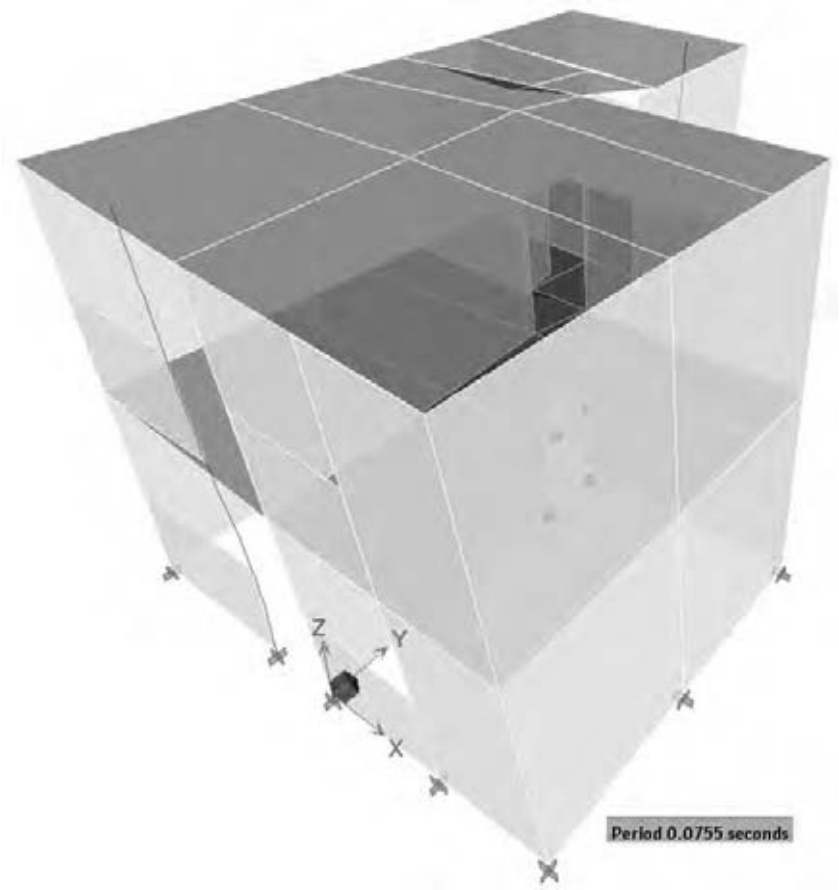
Check with two floors

The prototypes were checked with two levels, since the prototypes have been projected for two floors. In the following graph, is showed only prototype 3 with two levels

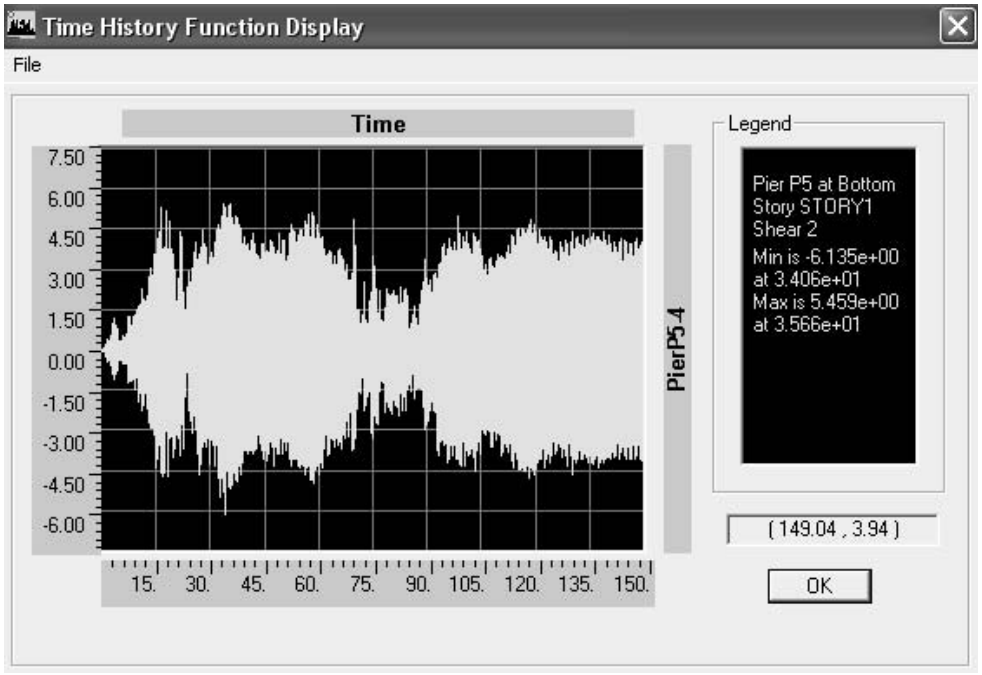
The period of vibration in the direction “x” is 0.1183 second

JOSÉ ALBERTO CERO MARTINEZ
INGENIERO CIVIL
Reg. del Colegio de Ingenieros Nº 80207

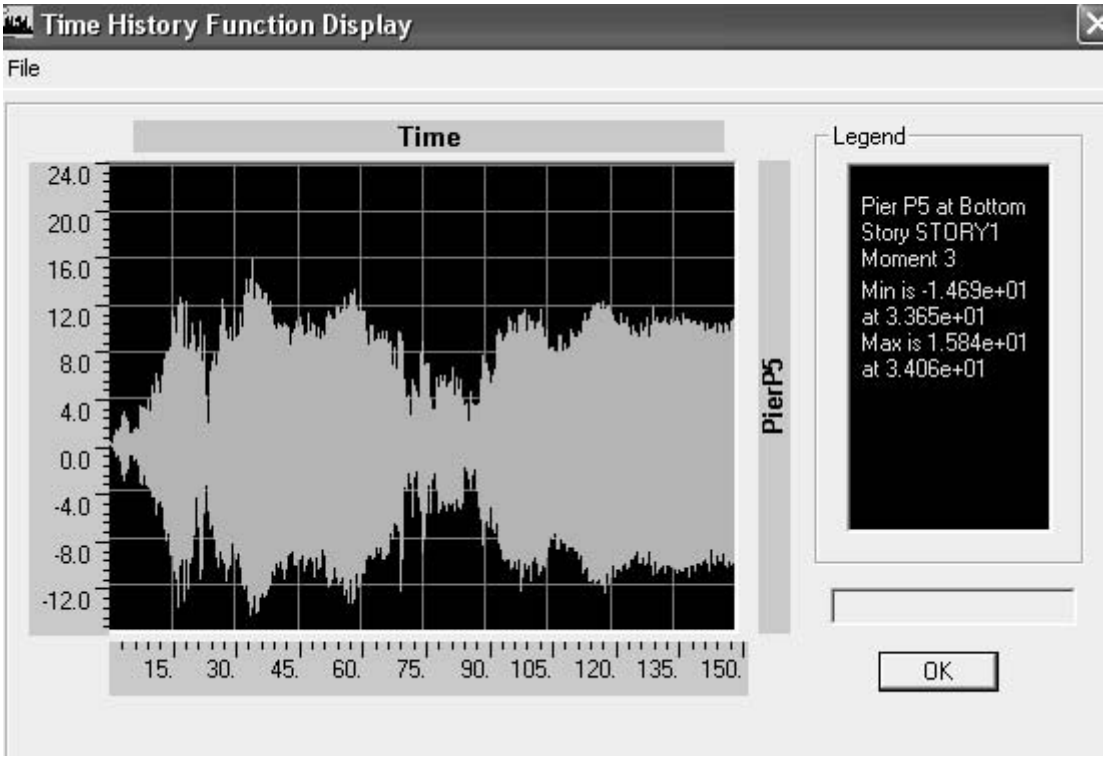
The period of vibration in the direction “y” is 0.0755 second



The response of the shear force in the first floor is 6.135 Tn



The response of the moment in the first floor is 15.84 Tn·m



The shear capacity of the wall (VR) can be checked according to the E.070 code, not taking into account the axial load, we obtain a resistant shear of the most critic wall critic, calculating with the following data we obtain:

v´m= 5.1 kg/cm2 (handcrafted brick)
L=315 cm
t=13 cm

$$VR = 0.5 \cdot v'm \cdot L \cdot t$$

VR= 0.5·(5.1)·(315)·(13)
VR=10442 kg
VR=10.44 Tn, value greater than 6.135 Tn OK

Appendix 5

TYPICAL SHOPPING LIST OF PROTOTYPE DRAWINGS

Typical Shopping list of Prototype 1

RESUMEN PRESUPUESTO PROTOTIPO 1 Nº 06

PROYECTO : ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU
UBICACIÓN : PUEBLO NUEVO - LA TINGUIÑA - INDEPENDENCIA

PARTIDA Nº	ESPECIFICACIONES	PARCIAL S/.
01.00.00	ARQUITECTURA	1659,79
02.00.00	ESTRUCTURAS	2379,89
03.00.00	INSTALACIONES ELECTRICAS	436,11
04.00.00	INSTALACIONES SANITARIAS	
05.00.00	TECHO	517,63
06.00.00	LETRINA	
	TOTAL S/. =	4993,42
	I.G.V. (19%) =	948,75
	TOTAL S/. =	**5942,17**

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**					
Subpresupuesto	**ARQUITECTURA PROTOTIPO 1 No. 6**					
Fecha	**27/09/2008**					
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**					
	Recurso		**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
	MANO DE OBRA					
	OPERARIO		hh	68.3028	5.00	341.51
	PEON		hh	50.2177	3.12	156.68
						498.19
	MATERIALES					
	CLAVOS PARA MADERA CON CABEZA DE 3"		kg	1.1664	4.62	5.39
	ARENA FINA		m3	0.3002	24.30	7.29
	ARENA GRUESA		m3	2.4531	28.00	68.69
	LADRILLO KING KONG ARTESANAL		u	973.4400	0.44	428.31
	CEMENTO PORTLAND TIPO I (42.5 kg)		bls	14.6082	14.70	214.74
	BISAGRA DE FIERRO DE 3 1/2"		u	3.0000	2.94	8.82
	ALDABA DE FIERRO DE 2"		u	1.0000	3.00	3.00
	ARMELLAS 1"		pza	1.0000	1.68	1.68
	AGUA		m3	0.4245	6.72	2.85
	PUERTA CONTRAPLACADA TRIPLAY 4 MM (0.90 X 2.30)		u	1.0000	130.00	130.00
	VENTANA DE MADERA CON HOJAS DE TORNILLO (1.50 X		u	1.0000	152.00	152.00
	MADERA TORNILLO		p2	26.9394	3.89	104.79
	VIDRIO TRANSPARENTE INCOLORO SIMPLE		p2	19.0890	1.00	19.09
						1,146.66
	EQUIPOS					
	HERRAMIENTAS MANUALES		%MO			14.95
						14.95
				Total	S/.	**1,659.77**

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**
Subpresupuesto	**ESTRUCTURAS PROTOTIPO 1 No. 06**
Fecha	**01/10/2008**
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**

Recurso	Unidad	Cantidad	Precio S/.	Parcial S/.
MANO DE OBRA				
OPERARIO	hh	49.1963	5.00	245.98
PEON	hh	84.0972	3.12	262.38
				508.36
MATERIALES				
ALAMBRE NEGRO # 8	kg	7.4901	4.62	34.60
Clavos C/C 2" a 5"	kg	4.5732	2.65	12.12
ACERO CORRUGADO fy=4200 kg/cm2 GRADO 60	kg	117.7260	3.95	465.02
(ACERO CORRUGADO DE 3/8")	varilla	20.0000		
(ACERO CORRUGADO DE 1/4")	kg	26.6200		
PIEDRA CHANCADA DE 1/2"	m3	1.2166	40.50	49.27
PIEDRA GRANDE DE 8"	m3	5.3340	29.16	155.54
ARENA GRUESA	m3	1.1191	28.00	31.33
Alambre Recocido # 16	kg	5.6060	4.62	25.90
CEMENTO PORTLAND TIPO I (42.5 kg)	bls	22.6786	14.70	333.38
YESO	kg	0.7715	3.00	2.31
Manguera para nivelar	m	0.9258	0.50	0.46
HORMIGON (PUESTO EN OBRA)	m3	5.3340	24.30	129.62
AGUA	m3	5.7067	6.72	38.35
CORDEL	m	2.9317	0.20	0.59
MADERA TORNILLO INCLUYE CORTE PARA ENCOFRADO	p2	148.2109	3.89	576.54
Estacas	p2	0.3086	2.43	0.75
				1,855.78
EQUIPOS				
HERRAMIENTAS MANUALES	%MO			15.25
				15.25
		Total	S/.	2,379.40

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**
Subpresupuesto	**ELECTRICAS PROTOTIPO 1 No. 06**
Fecha	**27/09/2008**
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**

Recurso	Unidad	Cantidad	Precio S/.	Parcial S/.
MANO DE OBRA				
OPERARIO	hh	12.4534	5.00	62.27
PEON	hh	10.4534	3.12	32.61
				94.88
MATERIALES				
Casco plastico de 8 polos	u	1.0000	120.00	120.00
CONECTOR DE PVC DE 3/4"	u	6.1000	0.90	5.49
Cable TW_AWG # 14	m	44.0000	1.20	52.80
TOMACORRIENTE DOBLE BAKELITA	u	2.0000	7.20	14.40
Interruptor thermomagnetico de 2 x 20A	u	1.0000	30.00	30.00
Interruptor thermomagnetico de 2 x 15A	u	2.0000	28.00	56.00
Caja octogonal fº galv.liviana	u	2.1000	2.00	4.20
Caja rectangular fº galv. liviana	u	4.1000	2.00	8.20
Interruptor Simple bakelita 1switch	u	2.0600	2.20	4.53
CINTA AISLANTE 3m	u	0.6000	1.00	0.60
Pegamento para PVC agua forduit	gal	0.0600	60.00	3.60
Soquette con base	u	2.0000	1.50	3.00
Curva Liviano PVC SEL P/Inst. Electricas 3/4"	u	0.3000	0.50	0.15
Curva pesado PVC SAP P/Inst. Electricas 1"	u	0.4200	0.70	0.29
Tubería PVC SEL 3/4" x 3 m.	u	2.6250	0.75	1.97
Union PVC electrico SEL 3/4"	u	0.8250	0.50	0.41
Union PVC electrico SEL 1"	u	1.1550	0.70	0.81
Tubería PVC SEL 1"x 3m	u	3.6750	1.00	3.68
Tubería PVC SEL 3/4" x 3 m.	m	21.0000	0.75	15.75
Conexión a caja pvc 3/4"	u	4.0000	3.00	12.00
				337.88
EQUIPOS				
HERRAMIENTAS MANUALES	%MO			2.85
				2.85
		Total	S/.	435.61

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**
Subpresupuesto	**LOSA ALIGERADA PROTOTIPO 1 No. 06**
Fecha	**27/09/2008**
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**

Recurso	Unidad	Cantidad	Precio S/.	Parcial S/.
MANO DE OBRA				
OPERARIO	hh	5.4880	5.00	27.44
PEON	hh	10.9760	3.12	34.25
				61.69
MATERIALES				
ALAMBRE NEGRO # 8	kg	3.0870	4.62	14.26
Clavos C/C 2" a 5"	kg	2.4010	2.65	6.36
Material Impermeabilizante Plastico	m2	18.0075	2.00	36.02
Torta de Barro	m2	18.0075	2.00	36.02
Caña Guayaquil diametro 4"	m	43.7325	2.50	109.33
Caña Chancada	m2	18.0075	14.00	252.11
				454.09
EQUIPOS				
HERRAMIENTAS MANUALES	%MO			1.85
				1.85
		Total	S/.	517.63

Typical Shopping list of Prototype 2

RESUMEN PRESUPUESTO PROTOTIPO 2 No 05

PROYECTO : ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU
UBICACIÓN : PUEBLO NUEVO - LA TINGUIÑA - INDEPENDENCIA

PARTIDA N°	ESPECIFICACIONES	PARCIAL S/.
01.00.00	ARQUITECTURA	3977,57
02.00.00	ESTRUCTURAS	4753,97
03.00.00	INSTALACIONES ELECTRICAS	669,80
04.00.00	INSTALACIONES SANITARIAS	1395,54
05.00.00	TECHO	1080,00
06.00.00	LETRINA	
	TOTAL S/. =	11876,87
	I.G.V. (19%) =	2256,60
	TOTAL S/. =	**14133,47**

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**					
Subpresupuesto	**ARQUITECTURA PROTOTIPO 2 No. 05**					
Fecha	**27/09/2008**					
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**					
	Recurso		**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
	MANO DE OBRA					
	OPERARIO		hh	138.064	5.00	690.32
	PEON		hh	105.7659	3.12	329.99
						1,020.31
	MATERIALES					
	CLAVOS PARA MADERA CON CABEZA DE 3"		kg	2.4488	4.62	11.31
	ARENA FINA		m3	0.6936	24.30	16.85
	ARENA GRUESA		m3	5.1935	28.00	145.42
	LADRILLO KING KONG ARTESANAL		u	1,769.4300	0.44	778.55
	CEMENTO PORTLAND TIPO I (42.5 kg)		bls	30.0474	14.70	441.70
	BISAGRA DE FIERRO DE 3 1/2"		u	12.0000	2.94	35.28
	ALDABA DE FIERRO DE 2"		u	4.0000	3.00	12.00
	ARMELLAS 1"		pza	3.0000	1.68	5.04
	AGUA		m3	0.8818	6.72	5.93
	PUERTA MADERA TORNILLO TABLERO (0.90 X 2.30)		u	2.0000	235.00	470.00
	PUERTA CONTRAPLACADA TRIPLAY 4 MM (0.75 X 2.30)		u	1.0000	120.00	120.00
	PUERTA CONTRAPLACADA TRIPLAY 4 MM (0.90 X 2.30)		u	2.0000	130.00	260.00
	VENTANA DE MADERA CON HOJAS DE TORNILLO (1.70 X 1.35)		u	1.0000	172.00	172.00
	VENTANA DE MADERA CON HOJAS DE TORNILLO (1.50 X 1.35)		u	1.0000	152.00	152.00
	VENTANA DE MADERA CON HOJAS DE TORNILLO (1.20 X 0.45)		u	1.0000	41.00	41.00
	MADERA TORNILLO		p2	55.0579	3.89	214.18
	VIDRIO TRANSPARENTE INCOLORO SIMPLE		p2	45.4020	1.00	45.40
						2,926.65
	EQUIPOS					
	HERRAMIENTAS MANUALES		%MO			30.61
						30.61
				Total	S/.	**3,977.57**

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**				
Subpresupuesto	**ESTRUCTURAS PROTOTIPO 2 No. 05**				
Fecha	**01/10/2008**				
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**				
Recurso		**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
MANO DE OBRA					
OPERARIO		hh	100.5798	5.00	502.90
PEON		hh	171.9355	3.12	536.44
					1,039.34
MATERIALES					
ALAMBRE NEGRO # 8		kg	14.7000	4.62	67.91
Clavos C/C 2" a 5"		kg	9.1773	2.65	24.32
ACERO CORRUGADO fy=4200 kg/cm2 GRADO 60		kg	236.0295	3.95	932.32
(ACERO CORRUGADO DE 3/8")		varilla	38.0000		
(ACERO CORRUGADO DE 1/4")		kg	53.9700		
PIEDRA CHANCADA DE 1/2"		m3	2.3977	40.50	97.11
PIEDRA GRANDE DE 8"		m3	10.3740	29.16	302.51
ARENA GRUESA		m3	2.2072	28.00	61.80
Alambre Recocido # 16		kg	11.2698	4.62	52.07
CEMENTO PORTLAND TIPO I (42.5 kg)		bls	44.6632	14.70	656.55
YESO		kg	1.6800	3.00	5.04
Manguera para nivelar		m	2.0160	0.50	1.01
HORMIGON (PUESTO EN OBRA)		m3	10.3740	24.30	252.09
AGUA		m3	11.1094	6.72	74.66
CORDEL		m	6.3840	0.20	1.28
MADERA TORNILLO INCLUYE CORTE PARA ENCOFRADO		p2	296.4456	3.89	1,153.17
Estacas		p2	0.6720	2.43	1.63
					3,683.45
EQUIPOS					
HERRAMIENTAS MANUALES		%MO			31.18
					31.18
			Total	S/.	4,753.97

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**				
Subpresupuesto	**ELECTRICAS PROTOTIPO 2 No. 05**				
Fecha	**27/09/2008**				
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**				
	Recurso	**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
	MANO DE OBRA				
	OPERARIO	hh	21.5467	5.00	107.73
	PEON	hh	19.5467	3.12	60.99
					168.72
	MATERIALES				
	Casco plastico de 8 polos	u	1.0000	120.00	120.00
	CONECTOR DE PVC DE 3/4"	u	14.2000	0.90	12.78
	Cable TW_AWG # 14	m	101.3917	1.20	121.67
	TOMACORRIENTE DOBLE BAKELITA	u	4.0000	7.20	28.80
	Interruptor thermomagnetico de 2 x 20A	u	1.0000	30.00	30.00
	Interruptor thermomagnetico de 2 x 15A	u	2.0000	28.00	56.00
	Caja octogonal fº galv.liviana	u	5.2500	2.00	10.50
	Caja rectangular fº galv. liviana	u	9.2500	2.00	18.50
	Interruptor Simple bakelita 1switch	u	5.1500	2.20	11.33
	CINTA AISLANTE 3m	u	1.4000	1.00	1.40
	Pegamento para PVC agua forduit	gal	0.1000	60.00	6.00
	Soquette con base	u	5.0000	1.50	7.50
	Curva Liviano PVC SEL P/Inst. Electricas 3/4"	u	0.7200	0.50	0.36
	Curva pesado PVC SAP P/Inst. Electricas 1"	u	0.4800	0.70	0.34
	Tubería PVC SEL 3/4" x 3 m.	u	6.3000	0.75	4.73
	Union PVC electrico SEL 3/4"	u	1.9800	0.50	0.99
	Union PVC electrico SEL 1"	u	1.3200	0.70	0.92
	Tubería PVC SEL 1"x 3m	u	4.2000	1.00	4.20
	Tubería PVC SEL 3/4" x 3 m.	m	48.0000	0.75	36.00
	Conexión a caja pvc 3/4"	u	8.0000	3.00	24.00
					496.02
	EQUIPOS				
	HERRAMIENTAS MANUALES	%MO			5.06
					5.06
			Total	S/.	669.80

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORESISTENTE EN LA REPUBLICA DEL PERU**
Subpresupuesto	**ELECTRICAS PROTOTIPO 2 No. 05**
Fecha	**27/09/2008**
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**

Recurso	Unidad	Cantidad	Precio S/.	Parcial S/.
MANO DE OBRA				
OPERARIO	hh	72.3238	5.00	361.62
PEON	hh	60.2387	3.12	187.94
				549.56
MATERIALES				
Llave simple de Ducha	u	1.0000	15.00	15.00
Clavos C/C 2" a 5"	kg	1.7200	2.65	4.56
ARENA FINA	m3	0.0600	24.30	1.46
ARENA GRUESA	m3	1.4720	28.00	41.22
Inodoro Sifón jet blanco c/acces. Induval	u	1.0000	110.00	110.00
Lavatorio blanco c/caño y acces.	u	1.0000	100.00	100.00
Pegamento p/tubo pvc	gal	0.5430	55.00	29.87
LADRILLO KING KONG ARTESANAL	u	68.0000	0.44	29.92
CEMENTO PORTLAND TIPO I (42.5 kg)	bls	3.0000	14.70	44.10
Trampa "p" pvc desague sal 2"	u	2.0600	7.70	15.86
Lavadero para ropa, incluye accesorios	u	1.0000	110.00	110.00
CINTA TEFLON	u	1.2000	1.00	1.20
Yee pvc desague sal 2"	pza	3.0600	3.20	9.79
Yee pvc desague sal 4"	pza	3.0300	6.00	18.18
HORMIGON (PUESTO EN OBRA)	m3	0.6200	24.30	15.07
AGUA	m3	0.0200	6.72	0.13
Niple de fº galv. tipo iso-I 1/2"	u	4.0000	7.00	28.00
Codo ventilacion pvc desague sal 4" x 2"	pza	1.0000	3.90	3.90
Reduccion pvc desague sal 4" a 2"	pza	2.1000	6.05	12.71
Union universal fº galv. 1/2"	u	4.0000	6.00	24.00

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORESISTENTE EN LA REPUBLICA DEL PERU**				
Subpresupuesto	**ELECTRICAS PROTOTIPO 2 No. 05**				
Fecha	**27/09/2008**				
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**				
	Recurso	**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
	Adaptador pvc de 1/2"	u	4.0000	1.00	4.00
	Codo pvc desague sal 2" x 45º	pza	2.1000	1.71	3.59
	Codo pvc desague sal 2" x 90º	pza	8.3100	1.71	14.21
	Codo pvc desague sal 4" x 90º	pza	1.0300	3.90	4.02
	Codo pvc agua doble campana 1/2"	pza	18.0000	1.23	22.14
	Tee pvc agua s.p. 1/2"	pza	5.0000	1.50	7.50
	Sombrero ventilacion pvc desague sal 2"	pza	1.0500	3.50	3.68
	Tubo pvc desague sal 2" x 3 m	u	4.4650	12.00	53.58
	Tubo pvc desague sal 4" x 3 m	u	1.5277	33.00	50.41
	Tubo pvc agua s.p. clase 10 1/2"	pza	2.1420	8.77	18.79
	REGISTRO ROSCADO DE BRONCE DE 2"	pza	1.0000	7.20	7.20
	Valvula compuerta pesada 1/2"	u	2.0000	12.71	25.42
					829.49
	EQUIPOS				
	HERRAMIENTAS MANUALES	%MO			16.49
					16.49
			Total	S/.	1,395.54

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**				
Subpresupuesto	**TECHO CON CAÑA GUAYAQUIL PROTOTIPO 2 No. 05**				
Fecha	**27/09/2008**				
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**				
	Recurso	**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
	MANO DE OBRA				
	OPERARIO	hh	11.4496	5.00	57.25
	PEON	hh	22.8992	3.12	71.45
					128.69
	MATERIALES				
	ALAMBRE NEGRO # 8	kg	6.4404	4.62	29.75
	Clavos C/C 2" a 5"	kg	5.0394	2.65	13.35
	Material Impermeabilizante Plastico	m2	37.5690	2.00	75.14
	Torta de Barro	m2	37.5690	2.00	75.14
	Caña Guayaquil diametro 4"	m	91.2390	2.50	228.10
	Caña Chancada	m2	37.5690	14.00	525.97
					947.45
	EQUIPOS				
	HERRAMIENTAS MANUALES	%MO			3.86
					3.86
			Total	S/.	1,080.00

Typical Shopping list of Prototype 3

RESUMEN PRESUPUESTO PROTOTIPO 3 No 6

PROYECTO : ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU
UBICACIÓN : PUEBLO NUEVO - LA TINGUIÑA - INDEPENDENCIA

PARTIDA N°	ESPECIFICACIONES	PARCIAL S/.
01.00.00	ARQUITECTURA	4326,13
02.00.00	ESTRUCTURAS	5672,09
03.00.00	INSTALACIONES ELECTRICAS	724,63
04.00.00	INSTALACIONES SANITARIAS	794,51
05.00.00	TECHO	1334,66
06.00.00	LETRINA	944,18
	TOTAL S/. =	13796,21
	I.G.V. (19%) =	2621,28
	TOTAL S/. =	**16417,49**

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**					
Subpresupuesto	**ARQUITECTURA PROTOTIPO 3 No. 06**					
Fecha	**27/09/2008**					
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**					
	Recurso		**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
	MANO DE OBRA					
	OPERARIO		hh	155.8034	5.00	779.02
	PEON		hh	120.0742	3.12	374.63
						1,153.65
	MATERIALES					
	CLAVOS PARA MADERA CON CABEZA DE 3"		kg	2.7020	4.62	12.48
	ARENA FINA		m3	0.7710	24.30	18.74
	ARENA GRUESA		m3	6.2649	28.00	175.42
	LADRILLO KING KONG ARTESANAL		u	1,974.1800	0.44	868.64
	CEMENTO PORTLAND TIPO I (42.5 kg)		bls	35.2201	14.70	517.74
	BISAGRA DE FIERRO DE 3 1/2"		u	12.0000	2.94	35.28
	ALDABA DE FIERRO DE 2"		u	4.0000	3.00	12.00
	ARMELLAS 1"		pza	3.0000	1.68	5.04
	AGUA		m3	1.0413	6.72	7.00
	PUERTA MADERA TORNILLO TABLERO (0.90 X 2.30)		u	2.0000	235.00	470.00
	PUERTA CONTRAPLACADA TRIPLAY 4 MM (0.90 X 2.30)		u	2.0000	130.00	260.00
	VENTANA DE MADERA CON HOJAS DE TORNILLO (1.70 X 1.35)		u	1.0000	172.00	172.00
	VENTANA DE MADERA CON HOJAS DE TORNILLO (1.50 X 1.35)		u	1.0000	152.00	152.00
	VENTANA DE MADERA CON HOJAS DE TORNILLO (1.70 X 1.05)		u	1.0000	134.00	134.00
	MADERA TORNILLO		p2	61.5347	3.89	239.37
	VIDRIO TRANSPARENTE INCOLORO SIMPLE		p2	58.1700	1.00	58.17
						3,137.87
	EQUIPOS					
	HERRAMIENTAS MANUALES		%MO			34.61
						34.61
				Total	S/.	**4,326.13**

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**
Subpresupuesto	**ESTRUCTURAS PROTOTIPO 3 No 06**
Fecha	**01/10/2008**
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**

Recurso	Unidad	Cantidad	Precio S/.	Parcial S/.
MANO DE OBRA				
OPERARIO	hh	117.7804	5.00	588.90
PEON	hh	199.4001	3.12	622.13
				1,211.03
MATERIALES				
ALAMBRE NEGRO # 8	kg	18.0000	4.62	83.16
Clavos C/C 2" a 5"	kg	11.0210	2.65	29.21
ACERO CORRUGADO fy=4200 kg/cm2 GRADO 60	kg	288.5610	3.95	1,139.82
(ACERO CORRUGADO DE 3/8")	varilla	46.0000		
(ACERO CORRUGADO DE 1/4")	kg	64.8400		
PIEDRA CHANCADA DE 1/2"	m3	2.8642	40.50	116.00
PIEDRA GRANDE DE 8"	m3	12.1800	29.16	355.17
ARENA GRUESA	m3	2.6414	28.00	73.96
Alambre Recocido # 16	kg	13.9012	4.62	64.22
CEMENTO PORTLAND TIPO I (42.5 kg)	bls	53.4460	14.70	785.66
YESO	kg	2.0675	3.00	6.20
Manguera para nivelar	m	2.4810	0.50	1.24
HORMIGON (PUESTO EN OBRA)	m3	12.1800	24.30	295.97
AGUA	m3	13.0610	6.72	87.77
CORDEL	m	7.8565	0.20	1.57
MADERA TORNILLO INCLUYE CORTE PARA ENCOFRADO	p2	355.4694	3.89	1,382.78
Estacas	p2	0.8270	2.43	2.01
				4,424.73
EQUIPOS				
HERRAMIENTAS MANUALES	%MO			36.33
				36.33
	Total		S/.	5,672.09

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**				
Subpresupuesto	**ELECTRICAS PROTOTIPO 3 No. 06**				
Fecha	**27/09/2008**				
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**				
	Recurso	**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
	MANO DE OBRA				
	OPERARIO	hh	24.0801	5.00	120.40
	PEON	hh	22.0801	3.12	68.89
					189.29
	MATERIALES				
	Casco plastico de 8 polos	u	1.0000	120.00	120.00
	CONECTOR DE PVC DE 3/4"	u	15.2500	0.90	13.73
	Cable TW_AWG # 14	m	110.3917	1.20	132.47
	TOMACORRIENTE DOBLE BAKELITA	u	5.0000	7.20	36.00
	Interruptor thermomagnetico de 2 x 20A	u	1.0000	30.00	30.00
	Interruptor thermomagnetico de 2 x 15A	u	2.0000	28.00	56.00
	Caja octogonal fº galv.liviana	u	5.2500	2.00	10.50
	Caja rectangular fº galv. liviana	u	10.2500	2.00	20.50
	Interruptor Simple bakelita 1switch	u	5.1500	2.20	11.33
	CINTA AISLANTE 3m	u	1.5000	1.00	1.50
	Pegamento para PVC agua forduit	gal	0.1200	60.00	7.20
	Soquette con base	u	5.0000	1.50	7.50
	Curva Liviano PVC SEL P/Inst. Electricas 3/4"	u	0.9600	0.50	0.48
	Curva pesado PVC SAP P/Inst. Electricas 1"	u	0.4800	0.70	0.34
	Tubería PVC SEL 3/4" x 3 m.	u	8.4000	0.75	6.30
	Union PVC electrico SEL 3/4"	u	2.6400	0.50	1.32
	Union PVC electrico SEL 1"	u	1.3200	0.70	0.92
	Tubería PVC SEL 1"x 3m	u	4.2000	1.00	4.20
	Tubería PVC SEL 3/4" x 3 m.	m	52.5000	0.75	39.38
	Conexión a caja pvc 3/4"	u	10.0000	3.00	30.00
					529.66
	EQUIPOS				
	HERRAMIENTAS MANUALES	%MO			5.68
					5.68
			Total	S/.	724.63

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**				
Subpresupuesto	**SANITARIAS PROTOTIPO 3 No. 06**				
Fecha	**27/09/2008**				
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**				
	Recurso	**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
	MANO DE OBRA				
	OPERARIO	hh	35.1069	5.00	175.53
	PEON	hh	50.5817	3.12	157.81
					333.35
	MATERIALES				
	Clavos C/C 2" a 5"	kg	1.7200	2.65	4.56
	ARENA FINA	m3	0.0600	24.30	1.46
	ARENA GRUESA	m3	1.6000	28.00	44.80
	Pegamento p/tubo pvc	gal	0.3040	55.00	16.72
	LADRILLO KING KONG ARTESANAL	u	68.0000	0.44	29.92
	CEMENTO PORTLAND TIPO I (42.5 kg)	bls	3.0000	14.70	44.10
	Trampa "p" pvc desague sal 2"	u	2.0300	7.70	15.63
	Lavadero para ropa, incluye accesorios	u	1.0000	110.00	110.00
	CINTA TEFLON	u	1.1000	1.00	1.10
	Yee pvc desague sal 2"	pza	2.0300	3.20	6.50
	HORMIGON (PUESTO EN OBRA)	m3	0.6200	24.30	15.07
	AGUA	m3	0.0200	6.72	0.13
	Niple de fº galv. tipo iso-I 1/2"	u	2.0000	7.00	14.00
	SUMIDERO DE BRONCE DE 2"	pza	1.0000	5.40	5.40
	Union universal fº galv. 1/2"	u	2.0000	6.00	12.00
	Adaptador pvc de 1/2"	u	2.0000	1.00	2.00
	Codo pvc desague sal 2" x 90º	pza	5.2300	1.71	8.94
	Codo pvc agua doble campana 1/2"	pza	11.0000	1.23	13.53
	Tee pvc agua s.p. 1/2"	pza	1.0000	1.50	1.50
	Tubo pvc desague sal 2" x 3 m	u	2.6250	12.00	31.50
	Tubo pvc desague sal 4" x 3 m	u	1.1808	33.00	38.97
	Tubo pvc agua s.p. clase 10 1/2"	pza	2.3520	8.77	20.63
	Valvula compuerta pesada 1/2"	u	1.0000	12.71	12.71
					451.16
	EQUIPOS				
	HERRAMIENTAS MANUALES	%MO			10.00
					10.00
			Total	S/.	794.51

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**				
Subpresupuesto	**TECHO CON CAÑA GUAYAQUIL PROTOTIPO 3 No. 06**				
Fecha	**27/09/2008**				
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**				
Recurso		**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
MANO DE OBRA					
OPERARIO		hh	14.1504	5.00	70.75
PEON		hh	28.3008	3.12	88.30
					159.05
MATERIALES					
ALAMBRE NEGRO # 8		kg	7.9596	4.62	36.77
Clavos C/C 2" a 5"		kg	6.1908	2.65	16.41
Material Impermeabilizante Plastico		m2	46.4310	2.00	92.86
Torta de Barro		m2	46.4310	2.00	92.86
Caña Guayaquil diametro 4"		m	112.7610	2.50	281.90
Caña Chancada		m2	46.4310	14.00	650.03
					1,170.84
EQUIPOS					
HERRAMIENTAS MANUALES		%MO			4.77
					4.77
			Total	S/.	1,334.66

Typical Shopping list of Prototype 4

RESUMEN PRESUPUESTO PROTOTIPO 4 No 05

PROYECTO : ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU
UBICACIÓN : PUEBLO NUEVO - LA TINGUIÑA - INDEPENDENCIA

PARTIDA N°	ESPECIFICACIONES	PARCIAL S/.
01.00.00	ARQUITECTURA	5552,20
02.00.00	ESTRUCTURAS	6944,46
03.00.00	INSTALACIONES ELECTRICAS	912,86
04.00.00	INSTALACIONES SANITARIAS	1627,87
05.00.00	TECHO	1633,47
06.00.00	LETRINA	
	TOTAL S/. =	16670,86
	I.G.V. (19%) =	3167,46
	TOTAL S/. =	**19838,33**

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**				
Subpresupuesto	**ARQUITECTURA PROTOTIPO 4 No. 05**				
Fecha	**27/09/2008**				
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**				
	Recurso	**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
	MANO DE OBRA				
	OPERARIO	hh	208.0791	5.00	1,040.40
	PEON	hh	162.3612	3.12	506.57
					1,546.96
	MATERIALES				
	CLAVOS PARA MADERA CON CABEZA DE 3"	kg	3.7870	4.62	17.50
	ARENA FINA	m3	1.1212	24.30	27.25
	ARENA GRUESA	m3	7.8094	28.00	218.66
	LADRILLO KING KONG ARTESANAL	u	2,504.9700	0.44	1,102.19
	CEMENTO PORTLAND TIPO I (42.5 kg)	bls	44.9744	14.70	661.12
	BISAGRA DE FIERRO DE 3 1/2"	u	15.0000	2.94	44.10
	ALDABA DE FIERRO DE 2"	u	5.0000	3.00	15.00
	ARMELLAS 1"	pza	5.0000	1.68	8.40
	AGUA	m3	1.3231	6.72	8.89
	PUERTA MADERA TORNILLO TABLERO (0.90 X 2.30)	u	2.0000	235.00	470.00
	PUERTA CONTRAPLACADA TRIPLAY 4 MM (0.75 X 2.30)	u	1.0000	120.00	120.00
	PUERTA CONTRAPLACADA TRIPLAY 4 MM (0.90 X 2.30)	u	2.0000	130.00	260.00
	VENTANA DE MADERA CON HOJAS DE TORNILLO (1.70 X 1.35)	u	1.0000	172.00	172.00
	VENTANA DE MADERA CON HOJAS DE TORNILLO (1.50 X 1.35)	u	1.0000	152.00	152.00
	VENTANA DE MADERA CON HOJAS DE TORNILLO (1.05 X 1.35)	u	1.0000	107.00	107.00
	VENTANA DE MADERA CON HOJAS DE TORNILLO (1.20 X 0.45)	u	1.0000	41.00	41.00
	VENTANA DE MADERA CON HOJAS DE TORNILLO (1.70 X 1.05)	u	1.0000	134.00	134.00
	MADERA TORNILLO	p2	83.5714	3.89	325.09
	VIDRIO TRANSPARENTE INCOLORO SIMPLE	p2	74.6340	1.00	74.63
					3,958.83
	EQUIPOS				
	HERRAMIENTAS MANUALES	%MO			46.41
					46.41
			Total	S/.	5,552.20

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**				
Subpresupuesto	**ESTRUCTURAS PROTOTIPO 4 No. 05**				
Fecha	**01/10/2008**				
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**				
Recurso		**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
MANO DE OBRA					
OPERARIO		hh	147.2892	5.00	736.45
PEON		hh	252.0813	3.12	786.49
					1,522.94
MATERIALES					
ALAMBRE NEGRO # 8		kg	22.8000	4.62	105.34
Clavos C/C 2" a 5"		kg	13.5176	2.65	35.82
ACERO CORRUGADO fy=4200 kg/cm2 GRADO 60		kg	339.9900	3.95	1,342.96
(ACERO CORRUGADO DE 3/8")		varilla	55.0000		
(ACERO CORRUGADO DE 1/4")		kg	75.5600		
PIEDRA CHANCADA DE 1/2"		m3	3.5112	40.50	142.20
PIEDRA GRANDE DE 8"		m3	15.0675	29.16	439.37
ARENA GRUESA		m3	3.2320	28.00	90.50
Alambre Recocido # 16		kg	16.2571	4.62	75.11
CEMENTO PORTLAND TIPO I (42.5 kg)		bls	65.2659	14.70	959.41
YESO		kg	2.5625	3.00	7.69
Manguera para nivelar		m	3.0750	0.50	1.54
HORMIGON (PUESTO EN OBRA)		m3	15.0675	24.30	366.14
AGUA		m3	16.1443	6.72	108.49
CORDEL		m	9.7375	0.20	1.95
MADERA TORNILLO INCLUYE CORTE PARA ENCOFRADO		p2	436.2058	3.89	1,696.84
Estacas		p2	1.0250	2.43	2.49
					5,375.84
EQUIPOS					
HERRAMIENTAS MANUALES		%MO			45.69
					45.69
			Total	S/.	6,944.46

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**				
Subpresupuesto	**ELECTRICAS PROTOTIPO 4 No. 05**				
Fecha	**27/09/2008**				
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**				
	Recurso	**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
	MANO DE OBRA				
	OPERARIO	hh	31.5468	5.00	157.73
	PEON	hh	29.5468	3.12	92.19
					249.92
	MATERIALES				
	Casco plastico de 8 polos	u	1.0000	120.00	120.00
	CONECTOR DE PVC DE 3/4"	u	21.3500	0.90	19.22
	Cable TW_AWG # 14	m	154.3667	1.20	185.24
	TOMACORRIENTE DOBLE BAKELITA	u	7.0000	7.20	50.40
	Interruptor thermomagnetico de 2 x 20A	u	1.0000	30.00	30.00
	Interruptor thermomagnetico de 2 x 15A	u	2.0000	28.00	56.00
	Caja octogonal fº galv.liviana	u	7.3500	2.00	14.70
	Caja rectangular fº galv. liviana	u	14.3500	2.00	28.70
	Interruptor Simple bakelita 1switch	u	7.2100	2.20	15.86
	CINTA AISLANTE 3m	u	2.1000	1.00	2.10
	Pegamento para PVC agua forduit	gal	0.1500	60.00	9.00
	Soquette con base	u	7.0000	1.50	10.50
	Curva Liviano PVC SEL P/Inst. Electricas 3/4"	u	1.3200	0.50	0.66
	Curva pesado PVC SAP P/Inst. Electricas 1"	u	0.4800	0.70	0.34
	Tubería PVC SEL 3/4" x 3 m.	u	11.5500	0.75	8.66
	Union PVC electrico SEL 3/4"	u	3.6300	0.50	1.82
	Union PVC electrico SEL 1"	u	1.3200	0.70	0.92
	Tubería PVC SEL 1"x 3m	u	4.2000	1.00	4.20
	Tubería PVC SEL 3/4" x 3 m.	m	73.5000	0.75	55.13
	Conexión a caja pvc 3/4"	u	14.0000	3.00	42.00
					655.44
	EQUIPOS				
	HERRAMIENTAS MANUALES	%MO			7.50
					7.50
			Total	S/.	912.86

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORRESISTENTE EN LA REPUBLICA DEL PERU**
Subpresupuesto	**SANITARIAS PROTOTIPO 4 No. 05**
Fecha	**27/09/2008**
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**

Recurso	Unidad	Cantidad	Precio S/.	Parcial S/.
MANO DE OBRA				
OPERARIO	hh	87.1877	5.00	435.94
PEON	hh	78.9193	3.12	246.23
				682.17
MATERIALES				
Llave simple de Ducha	u	1.0000	15.00	15.00
Clavos C/C 2" a 5"	kg	1.7200	2.65	4.56
ARENA FINA	m3	0.0600	24.30	1.46
ARENA GRUESA	m3	2.1280	28.00	59.58
Inodoro Sifón jet blanco c/acces. Induval	u	1.0000	110.00	110.00
Lavatorio blanco c/caño y acces.	u	1.0000	100.00	100.00
Pegamento p/tubo pvc	gal	0.6885	55.00	37.87
LADRILLO KING KONG ARTESANAL	u	68.0000	0.44	29.92
CEMENTO PORTLAND TIPO I (42.5 kg)	bls	3.0000	14.70	44.10
Trampa "p" pvc desague sal 2"	u	4.0900	7.70	31.49
Lavadero para ropa, incluye accesorios	u	1.0000	110.00	110.00
CINTA TEFLON	u	1.2000	1.00	1.20
Yee pvc desague sal 2"	pza	5.0900	3.20	16.29
Yee pvc desague sal 4"	pza	3.0300	6.00	18.18
HORMIGON (PUESTO EN OBRA)	m3	0.6200	24.30	15.07
AGUA	m3	0.0200	6.72	0.13
Niple de fº galv. tipo iso-I 1/2"	u	4.0000	7.00	28.00
Codo ventilacion pvc desague sal 4" x 2"	pza	1.0000	3.90	3.90
SUMIDERO DE BRONCE DE 2"	pza	1.0000	5.40	5.40
Reduccion pvc desague sal 4" a 2"	pza	2.1000	6.05	12.71
Union universal fº galv. 1/2"	u	4.0000	6.00	24.00

	Adaptador pvc de 1/2"	u	4.0000	1.00	4.00
	Codo pvc desague sal 2" x 45º	pza	2.1000	1.71	3.59
	Codo pvc desague sal 2" x 90º	pza	10.3900	1.71	17.77
	Codo pvc desague sal 4" x 90º	pza	1.0300	3.90	4.02
	Codo pvc agua doble campana 1/2"	pza	23.0000	1.23	28.29
	Tee pvc agua s.p. 1/2"	pza	6.0000	1.50	9.00
	Sombrero ventilacion pvc desague sal 2"	pza	1.0500	3.50	3.68
	Tubo pvc desague sal 2" x 3 m	u	6.1100	12.00	73.32
	Tubo pvc desague sal 4" x 3 m	u	1.5511	33.00	51.19
	Tubo pvc agua s.p. clase 10 1/2"	pza	3.2970	8.77	28.91
	REGISTRO ROSCADO DE BRONCE DE 2"	pza	1.0000	7.20	7.20
	Valvula compuerta pesada 1/2"	u	2.0000	12.71	25.42
					925.23
	EQUIPOS				
	HERRAMIENTAS MANUALES	%MO			20.47
					20.47
			Total	S/.	1,627.87

Precios y cantidades de recursos requeridos por tipo

Obra	**ESTUDIO DE RECONSTRUCCION CON VIVIENDAS SISMORESISTENTE EN LA REPUBLICA DEL PERU**					
Subpresupuesto	**TECHO CON CAÑA GUAYAQUIL P4 No. 05**					
Fecha	**27/09/2008**					
Lugar	**PUEBLO NUEVO - INDEPENDENCIA - LA TINGUIÑA**					
	Recurso		**Unidad**	**Cantidad**	**Precio S/.**	**Parcial S/.**
	MANO DE OBRA					
	OPERARIO		hh	17.3184	5.00	86.59
	PEON		hh	34.6368	3.12	108.07
						194.66
	MATERIALES					
	ALAMBRE NEGRO # 8		kg	9.7416	4.62	45.01
	Clavos C/C 2" a 5"		kg	7.5768	2.65	20.08
	Material Impermeabilizante Plastico		m2	56.8260	2.00	113.65
	Torta de Barro		m2	56.8260	2.00	113.65
	Caña Guayaquil diametro 4"		m	138.0060	2.50	345.02
	Caña Chancada		m2	56.8260	14.00	795.56
						1,432.97
	EQUIPOS					
	HERRAMIENTAS MANUALES		%MO			5.84
						5.84
				Total	S/.	**1,633.47**

Appendix 6

MANUAL OF IMPROVED BUILDING PERMIT FOR SAFER HOUSING

PERÚ Ministerio de Vivienda, Construcción y Saneamiento

Manual of Improved Building Permit for Safer Housing

Towards Reconstruction

September 2008

Japan International Cooperation Agency

TO READERS OF THIS BOOK

Big Earthquake was occurred in Ica region on August of 2007 and revealed vulnerability of houses against earthquake. Housing reconstruction needs safer housing against earthquake. Japan International Cooperation Agency (hereinafter referred to as “JICA”) has conducted the Study on Housing Reconstruction with Seismic-resistant Houses in the Republic of Peru (hereinafter referred to as “the Study”) in response to a request of the Government of the Republic of Peru (hereinafter referred to as “the Government of Peru”).

An idea of safer housing is come from concepts of Minimum Requirements, which illustrate the essence of structural aspects of housing in design, construction and inspection. JICA Study Team has prepared the minimum requirements of safer housing. The Minimum Requirements are guided by key requirements established in Sub-Project on Housing Administration Capacity Enhancement to improve the Vulnerability of Housing for Central Java and DIY Earthquake Reconstruction Program Indonesia which was conducted by JICA.

Based on the minimum requirements, i) manual of improved building permit for safer housing, ii) prototype drawings for safer housing, iii) manual of watching over construction of safer housing and iv) manual of simple inspection for construction of safer housing were prepared by the Study. Those materials play an important role in facilitating safer housing reconstruction of affected families. Majority of the affected families cannot prepare the necessary drawings for building permit due to a lack of budget. The prototype drawings can be adopted as the necessary drawings. The manual of watching over construction of safer housing can be applicable for house owner to check whether or not house construction is appropriate. Taking user-friendly manual into consideration the manual was prepared for the one who has no construction knowledge to understand appropriate construction methods easily.

The manual of simple inspection for safer housing can assist in developing capability of municipal inspectors for safer housing construction. Those two manuals help to complement a lack of municipality inspectors.

Existing building permit system itself needs to be optimized and disseminated due to lots of applicants who reconstruct their houses without delay. For that reason, JICA Study Team has proposed to introduce the prototype drawings and the above-mentioned manuals into the existing building permit system.

District municipality will implement the project bank for building permit, by making use of the prototype drawings. The project bank benefits building permit applicants because the prototype drawings show affordable construction costs and are previously approved.

Construction of safer housing will be disseminated through activities based on the said manuals. In other words, the house construction will be watched over carefully by house owner by using the manual of watching over construction and inspected exactly by municipality inspector by using the manual of simple inspection.

In order to put the aforementioned into practice, this book "Manual of Improved Building Permit for Safer Housing" was prepared by the JICA Study Team. The readers of this book are government officials and professional technicians of district municipalities. This book will be used for textbook of on-the-job training for the technical professional personnel of the municipality.

This book introduces the necessary knowledge to the reader in order to understand the system of improved building permit for safer housing.

Chapter I describes how to use the Manual of Improved Building Permit. This chapter provides the readers with necessary knowledge of the improved building permit administration and required structure of the administration. The necessary knowledge consists of legal, technical and administrative aspects. Important laws and regulations concerning building permit are selected and listed in order to understand building permit and the related matters. Key factors of safer housing with confined masonry are illustrated by the minimum requirements, namely, a) quality of materials, b) structural section of main members and c) connection of structural members. Prototype drawings are introduced as typical drawings to be classified under conditions of affordable construction cost, soil characteristics, future expansion, and availabilities of electricity and sanitation. With respect to the manual of watching over construction of safer housing and the manual of simple inspection for construction of safer housing, it is shown how to use those manuals in a process of building permit and construction. Majority of house owners use auto-construction method due to saving their construction budgets. Required conditions of auto-construction are explained to avoid misunderstandings about a definition of auto-construction diffused among local people. A flowchart with the steps of the entire process of improved building permit and construction inspection is shown.

The manual itself is shown in Chapter II and Chapter III.

Chapter II shows a comprehensive flowchart of the improved building permit system and points out important matters in each stage of the flowchart.

Chapter III shows the practical procedures in nine (9) steps. Each step accounts for a practical administration procedure within the process of building permit and construction. First step is to disseminate the improved building permit system. The items mentioned in this step include what to disseminate and how to disseminate. Second step refers to how to give advices on selection of the prototype drawings to building permit applicants. Accordingly, a person in charge of building permit section of district municipality shall have a detailed knowledge of the prototype drawings and explain the drawings characteristics to the building permit applicants. Third step is how to prepare the

documents for the building permit application. Fourth step shows the administrative procedures when receiving the application. Fifth step is to explain evaluation criteria to issue building permit. Sixth step is to issue the building permit and at the same time to provide the applicants with the selected prototype drawings and the manual of watching over construction of safer housing. It is recommended to make a presentation on how to use manual provided for every ten (10) applicants who got authorization. Seventh step is to explain the manual of watching over construction of safer housing. Eighth step is to explain the manual of simple inspection for construction of safer housing. At seventh and eighth steps, the most important topic is how to make use of checklists shown in the two manuals. Ninth step is to explain data-banking and how to use statistic data of completed houses with building permit.

In order to make full use of this book in the administration scene, the related laws and regulations as well as the diffusion material are included in an Appendix.

Hopefully, this book contributes to housing reconstruction in Ica region.

Dr. Sugiyama Kyoichi
Expert of seismic resistant structure
JICA Study Team

The following members of JICA Study Team are the writers of this book.

Kobayashi Ichiro, Team Leader
Sugiyama Kyoichi, Expert of Seismic Resistant Structure
Okayama Kumi, Administrator
Iván Alonso Zapata Rojas, Structural Engineer
Hernan Oscar Zaragoza Ancalla, Document Specialist
Jhon Urdánegui Urdánegui, Civil Engineer
Joan Willy Hugo Guardia, Structural Engineer
Cesar Enrique Diaz Munoz, CAD operator
Gustavo Adolfo Quijada Kida, Structural Engineer

The Study on Housing Reconstruction with Seismic-resistant House in the Republic of Peru

ACKNOWLEDGEMENTS

This book was prepared by JICA Study Team, thanks to the united efforts of Ministry of Housing, Construction and Sanitation (hereinafter referred to as “MVCS”) which implemented the Study jointly.

Dr. QF Rómulo Triveño Pinto, President of Ica Region, has made district municipalities in Ica Region a request of cooperation with JICA Study Team as smooth implementation of the Study.

Mayors of the target district municipalities, where a pilot project of the Study is implemented, provide officials and place for on-the-job training of the Study to deal with needs from many people to reconstruct their houses. The mayors are; Mr. Lucio Juárez Ochoa of Pueblo Nuevo in Chincha province, Mr. Marino Ucharima Tacsi of Independencia in Pisco province and Dr. Ruben A.Velásquez Serna of La Tinguiña in Ica province.

Dr. Carlos Alberto Zavala Toledo, director of CISMID (Japan Peru Center for Earthquake Engineering and disaster mitigation) and associate professor of FIC/UNI (Faculty of Civil Engineering in National University of Engineering), who became technical advisor of the pilot project of the Study to have given many practical and professional advices to JICA Study Team. He authorized the minimum requirements in respect of civil engineering and approved this book as very practical, effective and complementary system to the existing building permit.

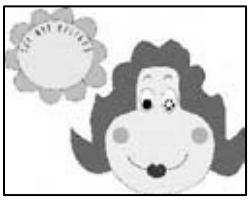
Lastly, I highly appreciate efforts of some other persons concerned with the Study.

Eng. Kobayashi Ichiro

Team Leader, JICA Study Team

TABLE OF CONTENTS

APPENDIX B: REFERENCE



CHAPTER I:

INSTRUCTIONS TO USE THE IMPROVED BUILDING PERMIT MANUAL

1.1 NECESSARY KNOWLEDGE OF THE ADMINISTRATION

Laws and regulations concerning building permit are summarized and the texts which come under the following laws and regulations are shown in the Appendix B.

1.1.1 Laws and Regulation concerning Building Permit

The rules that regulate the administrative process to obtain building permit are of national and municipal nature as follows;

(1) Law N°27972 - Organic Law of Municipalities

The present law has been consulted because local governments are the basic entities in the territorial organization of the State. It is through local governments that the population can be directly addressed, having powers that allow them to regulate over complementary regulations in the benefit of their respective localities.

Article 9º.- Attributions of the Municipal Council

- Subsect.5.- To approve the urban development plan.
- Subsect.8.- To approve, modify or abolish by-laws.
- Subsect.9.- Abolish or exonerate taxes, licenses and rights, according to the law.
- Subsect.14.- Approve norms that assure an effective local participation.

(2) National Regulation of Construction

The present regulation establishes the minimum criteria and requisites for the design and execution of construction; it is of compulsory application during the constructive process. Some regulations related to housing construction are referred below.

Title I Generalities

- Norm G.010 Basic considerations
- Norm G.020 General principles
- Norm G.030 Rights and responsibilities
- Norm G.050 Security in construction

Title II Urban Developments

II.1 Type of developments

- Norm TH.010 Residential developments

Title III Buildings

III.1. Architecture

- Norm A.020 Housing

III.2. Structures

- Norm E.030 Seismic resistant design
- Norm E.050 Soil and foundation
- Norm E.060 Reinforced concrete
- Norm E.070 Masonry

See Appendix B1

(3) LAW Nº27157.- Law of Building Regulation, from the Procedure for the Statement of a Construction Work Legal Existence (Declaratoria de Fábrica) and the Regime of Real Estate Units of Exclusive Property and Common Property regulated by Supreme Decree No 035-2006-VIVIENDA.

This norm and its regulation are very important because it establishes the administrative procedures for obtaining the building permit, conformity of work and the statement of a construction work legal existence.

Regulation of LAW Nº27157

i) Auto-construction

Article 2º.- Terms

2.2 Definition of auto-construction:

Article 47º.- Conditions for auto-construction

Article 92º.- Construction Supervision

ii) Building permit process for auto-construction:

Article 79º.- Building permit for auto-construction:

1. Submitting Drawings:
2. Without submitting Drawings:
   - Art. 80º.- Formalities: Procedures:
   - Art. 82º.- Submittal of Building Permit documents:
   - Art. 83º.- Project qualification:
   - Art. 84º.- Notification of the results and its effects:

See Appendix B2

(4) Law Nº29090 – Law of Urban Developments and Building Regulation

This Law was published on 25th of September, 2007 but as it has not been regulated, it is not in force yet. It greatly simplifies a building permit procedure:

Chapter I

- **Article 10º.-** Modes of approval:

  There are four modes to get the building permit:

  Mode A: Automatic approval, (Housing up to 120.00 m2 of construction).
- Mode B: Automatic approval with the signature of responsible professionals (buildings up to 5 stories, maximum size 3,000 m2).
- Mode C: Approval with previous evaluation of the Project by Urban reviewers or Technical Commissions, (buildings higher than 5 stories).
- Mode D: Approval with previous evaluation of the Technical Commission, (construction for industries).

Therefore, housing construction with bonus granted by the State belongs to Mode A.

Chapter III

- **Article 25º.-** Requisites:

  For Mode A :

  - FUO Part 1
  - Land title
  - Location plan and floor plan of the work to be executed.

See Appendix B3

(5) Law Nº27444.- Law of General Administrative Procedures.

This law is applicable to all entities of the public administration, regulating the administrative procedure and is basically supported in principles that allow a better administration of public functions. Two main important principles are mentioned:

Principle of speedup

- Those participating in the administrative procedure have to adjust their actions by providing the procedure with agility, avoiding processes that difficult the normal development or that constitute just formalities, in order to make a decision in a reasonable time, without prejudice to the due procedure or breaking the legal ordainment.

Principle of simplification.

- Procedures established by the administrative authority should be simple and all the unnecessary complexity must be eliminated. It means that the requisites should be rational and in proportion to the objectives. See Appendix 4

(6) MUNICIPALITIES TUPA (Single text of administrative procedures) :

TUPA (Single text of administrative procedures) regulates the procedures and requirements approved by the municipalities, to administrate the respective districts in an ordained way.

The requirements for building permit issue at the district municipalities of Independencia, La Tinguiña and Pueblo Nuevo are shown in Table 1.1.

(7) DIRECTIVE No. 002-77-INAP/DNR. NORMS FOR THE FORMULATION OF THE MANUAL OF ADMINISTRATIVE PROCEDURES

This directive is a tool which describes the actions to follow in the preparation of administrative functions according to the municipality works.

(8) ROF (Regulations for Organization and Functions) of the municipality

This Regulation for Organization and Functions is a technical normative document in administration. It regulates the organic structure of municipalities, general functions and relations of coordination and control for appropriate administration.

Table 1.1 Existing Requirements for Building Permit at the Three (3) District municipalities

	Requirements	Independencia	La Tinguiña	Pueblo Nuevo
1	Procedure sheet for Application	x	x	x
2	FUO Part 1 (application form)	x	x	X
3	Land title or Property certificate issued by the Public Registration Office	x	x	X
4	Application fee certificate	x	x	x
5	Parameter (Zoning) certificate	x	x	x
6	Location map	x	x	x
7	Architectural drawings	x	x	x
8	Structure drawings	x	x	x
9	Water services drawings	x	x	x
10	Electric power drawings	x	x	x
11	Colored photos	x	x	x
12	**Payments in NS./**			
13	Technical verification		x	
14	Building permit	x	x	x
15	Road and sidewalk wearing	x	x	
16	Three (3) work inspections		x	
17	Right of review	x	x	
18	Right of works supervision	x	x	x

Source) Interview survey by JICA Study Team about the above-mentioned information in the three municipalities

1.1.2 Minimum Requirements for Safer Housing

(1) Introduction of Minimum Requirements for Safer Housing

Minimum requirements for safer housing are minimum technical guidelines to design, construct and inspect safer housing of confined masonry against earthquake. Minimum Requirements were prepared taking into consideration the National Regulation of Construction and some manuals of construction procedures validated by authorized institutions of Peru.

Dr. Carlos Zavala, director of CISMID and associate professor of FIC/UNI provided technical advices for the preparation of the Minimum Requirements.

Minimum Requirements consists of three factors, namely:

- **Quality of Materials**

  Appropriate quality of construction materials to be used for housing construction

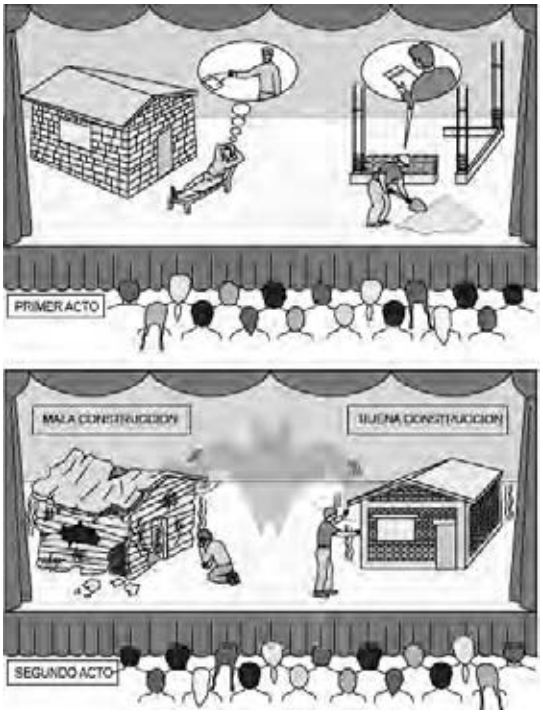
- **Structural Section of Main Members**

  Appropriate size of structural members for the housing reinforced concrete, plain concrete and masonry

- **Connection of Structural Members**

  Appropriate connections among the distinct structural members of housing

The minimum requirements are introduced in a way to be simply and easily understood because it is oriented toward people without construction knowledge.



Source) Study on Housing Reconstruction with Seismic-resistance Houses in the Republic of Peru conducted by JICA Study Team

(2) Relationship between Minimum Requirements and Building Permit

Building permit is the municipal document that allows the start of a housing construction work previous submittal of the requisites established by each municipality. This document is regulated under Law No. 27157

Among the requisites for the obtaining of the building permit for Auto-construction, there are: the application form, land title and drawings from the project bank of the municipality. These drawings are in accordance to the regulation in force and have been previously approved by the technical area of the Municipality.

As the minimum requirements are guidelines of technical nature for housing construction, the relation they have with the building permit is reflected in the technical aspects of the requisites, mainly in the structure drawings.

Structure drawings are based on the minimum requirements; technical specifications referring to the materials to be used, sections of structural members and the connection among them.

Table 1.2 Relationship between Minimum Requirements and Building Permit

	Minimum Requirements	Building permit (Structure Drawings)
Quality of Materials	• Design of materials accordingly to reinforced concrete, plain concrete and mortar (simple description) • Quality of wood to be used in the framing • Quality of bricks for the masonry walls • Water quality to be used in the construction	• Reinforced concrete, plain concrete and mortar (simple description) • Quality of bricks according to the maker's specification.
Structural Section of Main Members	• Minimum dimensions of foundation • Dimension of reinforced concrete members and the quantity of reinforcement steel • Dimension of structural walls and the distance between confinement members	• Minimum sections of foundation shown in the foundation drawings. • Section of reinforced concrete elements and the distribution of reinforced steel represented in the drawings. • Section of structural walls and the distance between confinement members presented in the drawings

Connection of Structural Members	• Confining column by anchoring to the reinforced tie beam and the ring beam • Connection between the wall and the column of the confined masonry housing • Overlapping of the steel bars and the thickness of the mortar joint between the wall bricks	• (Description through a detailed design) the anchoring of the confinement column to the reinforced tie beam and ring beam in the structure drawings • (Detailed in the drawing) the connection between the wall and the column of the confined masonry housing • (Detailed in the drawing) the overlapping of the steel bars and the thickness of the mortar joint between the wall bricks..

Source) Study on Housing Reconstruction with Seismic-resistance Houses in the Republic of Peru conducted by JICA Study Team

1.1.3 Prototype Drawings for Safer Housing

(1) Characteristics of Prototype Drawings

Prototype drawings are a complete set of drawings such as architecture, structure, electricity, and water and sewage installations for four (4) prototype housings. The prototype drawings designs fulfill the technical specifications of the National Regulation of Construction and the minimum requirements for safer housing. For the construction of prototype drawing housing, the Urban and Construction Parameters of the district has to be taken into account.

For the definition of the prototype drawings, economical and practical parameters were considered, so that the drawings could be used by the affected people under their actual conditions.

The matrix for the selection of the prototype drawings will be applied for the people who will reconstruct their houses, according to their particular situation such as type of Government's reconstruction subsidy received, soil type, availability of electric power supply and water supply, and a second store extension.

Housing construction costs by prototype drawings are classified as follows;

Prototype 1 (BONO 6000) = S/. 6 000.00

Prototype 2 (Techo Propio BFH) = S/. 13 400.00

Prototype 3 = S/. 15 400.00

Prototype 4 (BONO 6000 + Techo Propio BFH) = S/. 19 400.00

The characteristics of the prototype drawings are as follows.

- Based on the minimum requirements for safer housing
- Visual signs in order to identify easily the minimum requirements and contrast the graphic information presented on the drawings with the

written document

- Drawings presented in a manner easy to read
- Drawings with illustrations to identify the key points of housing construction
- Light and interesting format to facilitate the reading

(2) Prototype drawings as part of building permit

The prototype drawings have already been reviewed by the respective district municipalities. Prototype drawings should be approved and authorized by the technical department of each municipality previously to the building permit process.

In this way, the prototype drawings will be part of the documents to be submitted for the building permit. As the prototype drawings do not need technical approval, the process will be much faster and only the land title and other regular documents will be necessary.

MATRIX OF PROTOTYPE Nº 1

PROJECT: STUDY OF RECONSTRUCTION OF SEISMIC-RESISTANT HOUSING IN THE REPUBLIC OF PERU
LOCATION: PUEBLO NUEVO - LA TINGUIÑA - INDEPENDENCIA

CONSTRUCTION AREA		KIND OF SOIL / FOUNDATION		KIND OF ROOF	ELECTRICAL INSTALLATIONS	KIND OF SANITARY INSTALLATIONS	CODIFICATION	COST S/.	COST S/. INCL. IGV
		CHARACTERISTICS	FOOTING						
PROTOTYPE 1 BONO 6000	AREA 16.38 m2	REGULAR RESISTANCE GRANULAR MATERIAL WITH COBBLES OF SMALL TO BIG STONES sAcceptable soil 1.2 @ Mas kg/cm2	SIMPLE	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 01	6,848.19	8,149.35
						WITHOUT LATRINE	PROTOTYPE 1 No. 02	5,900.64	7,021.76
					NOT AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 03	6,412.08	7,630.38
						WITHOUT LATRINE	PROTOTYPE 1 No. 04	5,464.53	6,502.79
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 05	5,940.96	7,069.74
						WITHOUT LATRINE	PROTOTYPE 1 No. 06	4,993.42	5,942.17
					NOT AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 07	5,504.85	6,550.77
						WITHOUT LATRINE	PROTOTYPE 1 No. 08	4,557.31	5,423.20
		LOW RESISTANCE SAND OR CLAY WITHOUT COBBLES sAcceptable soil 0.8 @ 1.2 kg/cm2	REINFORCED	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 09	7,105.81	8,455.91
						WITHOUT LATRINE	PROTOTYPE 1 No. 10	6,158.27	7,328.34
					NOT AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 11	6,669.70	7,936.94
						WITHOUT LATRINE	PROTOTYPE 1 No. 12	5,722.16	6,809.37
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 13	6,198.59	7,376.32
						WITHOUT LATRINE	PROTOTYPE 1 No. 14	5,251.05	6,248.75
					NOT AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 15	5,762.48	6,857.35
						WITHOUT LATRINE	PROTOTYPE 1 No. 16	4,814.94	5,729.78

Figure 1.1 Example of matrix for the selection of prototype drawings

Source) Study on Housing Reconstruction with Seismic-resistance Houses in the Republic of Peru conducted by JICA Study Team

1.1.4 Manual of Watching over Construction of Safer Housing

(1) Characteristics of the Manual of Watching over Construction of Safer Housing

This manual was prepared based on the prototype drawings. The Watching Manual will be used by house owners so that they can watch over the construction process of their own housing. The manual contains a clear explanation of the minimum requirements for safer housing.

The manual aims to prevent construction mistakes by masons or carpenters. Also, the manual can be used to complement construction inspection of district municipality that could be limited by the lack of technical personnel for this task.

The Watching Manual provides clear and simple explanation because it is directed be used by house owners who have little construction knowledge.

The characteristics of the manual are as follows:

- Based on the minimum requirements for safer housing
- Relation with the procedures of watching over the construction of confined masonry housing, specifically with the prototype drawings of safer housing
- Simple and easy language, understandable to local people
- Illustrations that help understanding of the key points of watching over housing construction
- Light and interesting format, easy to read

(2) Watching Manual as a part of the Building Permit

The manual of watching over will be provided to the applicants together with the prototype drawings once the building permit is issued by the Municipality. The owner can watch over the construction of her/his housing from the beginning of the construction. The Municipality is in charge of giving the Manual to the house owners.

1.1.5 Manual of Simple Inspection for Construction of Safe Housing

The Manual of Simple Inspection is a document containing the main points to be considered in the housing construction inspection.

(1) Tasks to be carried out in the Municipality

a) Inspector Training

District municipality trains technical professional related to construction to execute inspection tasks. For that, the Municipality should:

- Make the person familiar with the technical vocabulary used in the work,
- Make the person familiar with the graphics and illustrations used in the Minimum Requirements,
- Show how to use the Minimum Requirements.
- Show how to use the check list of simple inspection, and
- Show how to conduct the site inspection.

b) Necessary documents

District municipality will issue written and/or graphic material that supports the intention of the procedures and certifies the right procedure of the same.

For that there should be:

- Building permit application form
- Previously selected prototype drawings for safer housing
- Minimum Requirements poster
- Poster or illustration of prototype drawings for safer housing

c) Inspection Schedule

The owner must inform the date of the commencement of works. District municipality will prepare written and/or graphic material showing the scheduled dates for inspection visits and a list of activities to be carried out during the visits.

The program is the following:

Work inspection:

- At the foundation work
- At the masonry work of wall
- At the roofing work

Inspection of Completion of Works

- At the work completion

(2) Tasks to be conducted in the Work

In this task, periodical visits are programmed with the purpose of verifying the execution of construction works and accordingly to the construction regulations. For instance, in the case of Prototype 1, four visits in distinct stages of the construction would be conducted.

a) First Inspection

It can be scheduled during the days 6th, 7th, 8th or 9th after the start of the construction; where the foundation work as well as the related activities will be verified.

b) Second Inspection

It can be scheduled during days 19th, 20th, 21st or 22nd f after the start of the construction; where the masonry work in walls and the related activities will be verified.

c) Third Inspection

It can be scheduled during days 34th, 35th, 36th or 37th after the start of the construction; where roofing works and related activities will be verified.

d) Fourth Inspection

At the construction completion, the owner may request the Fourth inspection to obtain the Work Completion Certificate.

See Appendix B5: Work Schedule and Simple Inspection

(3) Use of the Check list

In order to facilitate the inspection and information collection in the work, a check list for simple inspection is used. The check list was developed considering the order of activities and the fulfillment of the respective minimum requirements. For that, the corresponding conformity or not will be marked with an (x) and if necessary, remarks or corrections will be recorded to be verified in the next visit.

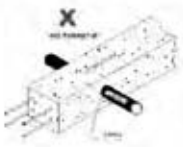
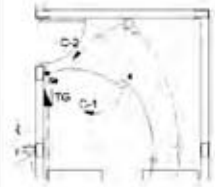
ACTIVITY	DESCRIPTION	MINIMUM REQUIREMENTS	ILLUSTRATION	No.	SATISFACTORY	NO SATISFACTORY	OBSERVACIONES
							
							

Figure 1.2 Example of Check List for Simple Inspection

Source) Study on Housing Reconstruction with Seismic-resistance Houses in the Republic of Peru conducted by JICA Study Team

See Appendix B6: Illustration of activities to be inspected

See Appendix B7: Check list for simple inspection

1.1.6 Auto-construction

Auto-construction is a housing constructed by the land owner, under the municipality inspection. The responsibility of works falls in the owner.

It is strictly recommended that in the case of Auto-construction, housing construction should be executed by a mason and not by the same owner.

(1) Definition of Auto-construction according to the District Municipalities

The difference in the concepts of auto-construction causes certain confusion in the administration of works executed under this method. Presently, there are different definitions of auto-construction in the three district municipalities, as shown in the following table.

Table 1.3 Definition of auto-construction by district municipality

DESCRIPTION	MUNICIPALITY		
	PUEBLO NUEVO	INDEPENDENCIA	LA TINGUIÑA
What do you understand as auto-construction?	*The owner works in his/her construction.*	*The same owners construct without technical direction*	*Users construct without hiring technical entities, do not carry out procedures for building permit*

Note: These definitions were provided by the respective representatives of the Public Works Office in each Municipality, according to an interview survey of JICA Study Team.

(2) Auto-construction Legality

We should keep in mind that auto-construction is legal, always when the following conditions are fulfilled:

- Exclusively for residential use
- Maximum height three stores.
- Land areas not bigger than the corresponding regulated area
- Respect for the zoning in force
- Approved by the municipality inspection
- Compulsory inspection

1.1.7 Process for Obtaining Improved Building Permit

(1) Characteristics of the Improved Building Permit

The characteristic of the improved building permit are: simplicity, rapidity and safety.

Building permit for safer housing will be supported by a project bank of the municipality, to allow the access of the local people to a building permit expending less money and time. In this respect, the prototype drawings for safer housing will be effectively applicable to the project bank. The construction of safer housing with the building permit will be assured by the house owner's surveillance, which will use the manual of watching over construction of safer housing. Inspection of safer housing is carried out by district municipality periodically, by using the manual of simple inspection for construction of safer housing. Flow charts of the improved building permit administration and the existing one are shown in the following figures.

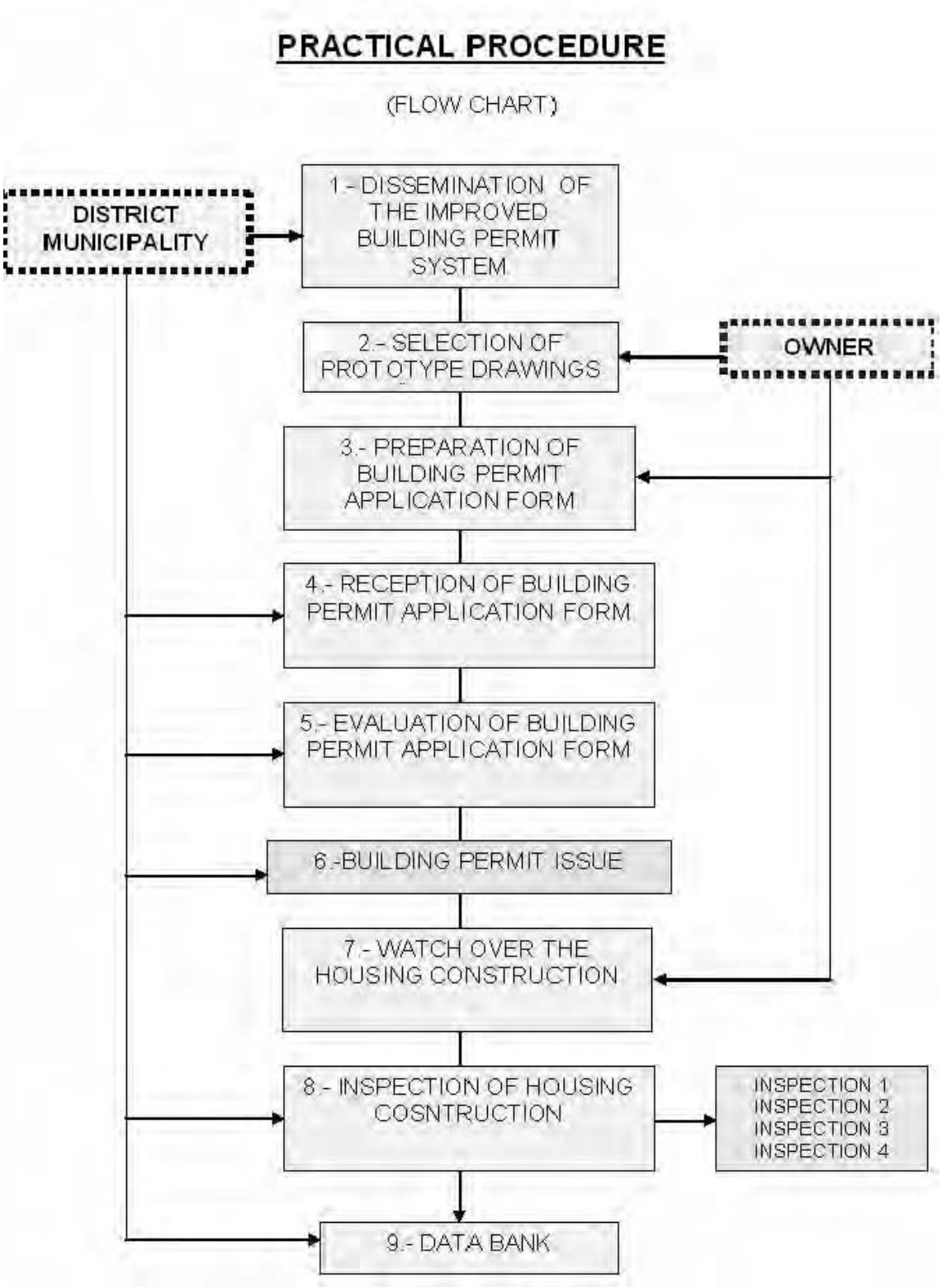


Figure 1.3 Improved building permit administration

Source) Study on Housing Reconstruction with Seismic-resistance Houses in the Republic of Peru conducted by JICA Study Team

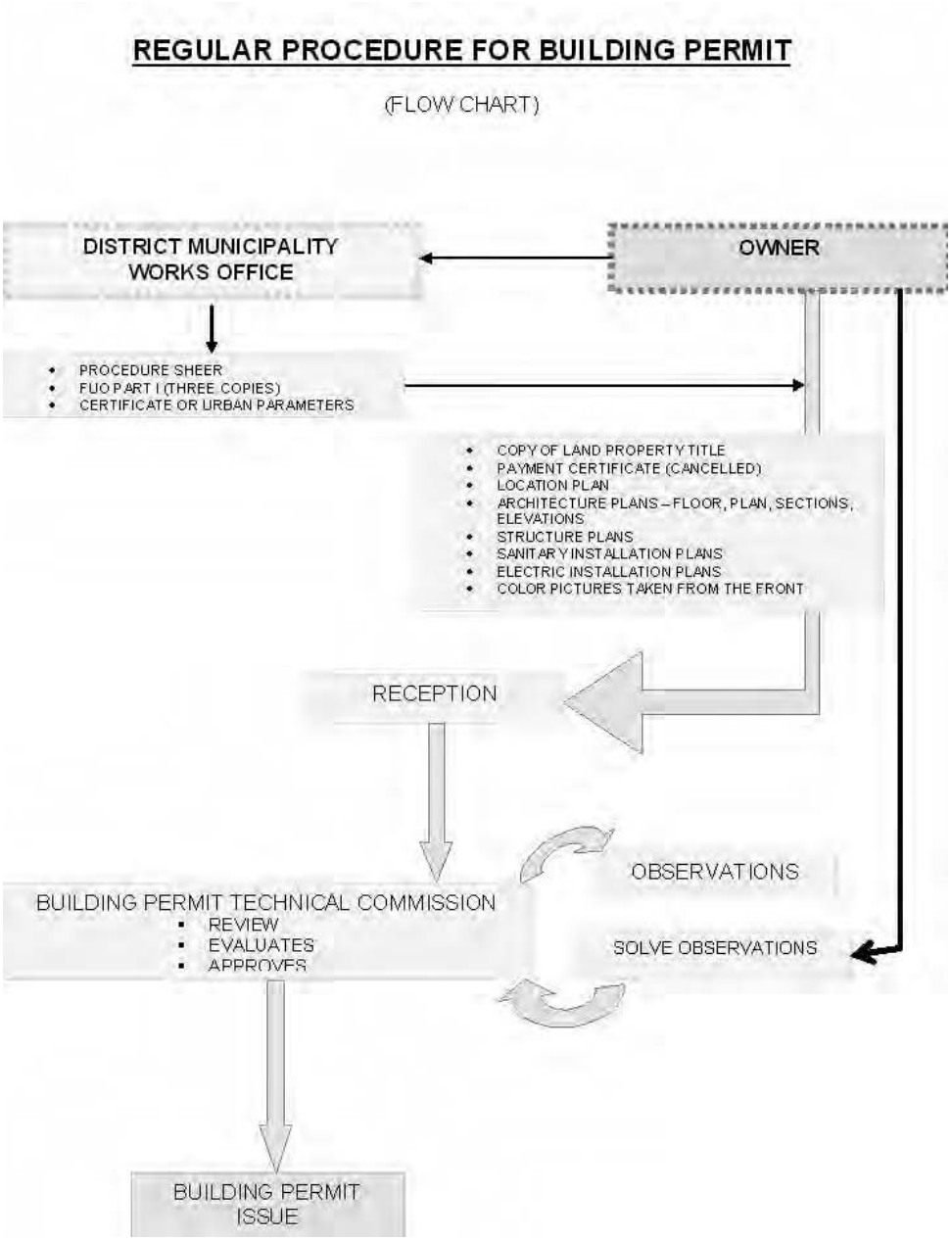


Figure 1.4 Existing building permit administration

Source) Study on Housing Reconstruction with Seismic-resistance Houses in the Republic of Peru conducted by JICA Study Team

1.2 REQUIRED STRUCTURE OF THE ADMINISTRATION

1.2.1 Assignment of Personnel for the Building Permit Section

(1) Organization of the improved building permit section in district municipality

The technical area to process the building permit in the municipality corresponds to the urban development and infrastructure office.

(2) Personnel needed for the improved building permit process

The personnel needed for the improved building permit process are as follows:

- One (1) civil engineer or architect, in charge of assisting in the selection of prototype drawings, evaluating the documents submitted by the applicants for obtaining the building permit (FUO Part 1, land title and certificate of payment); also in charge of conducting construction inspection. She/he should conduct workshops about use of the manual of watching over construction of safer housing to the approved applicants every time ten (10) applicants are grouped._
- One (1) office clerk in charge of organizing all documents during the whole process.
- Some other technical professionals trained by an engineer or architect to conduct the required inspections. Reports issued by said inspectors will have to be signed by the responsible officer.

1.2.2 Equipment Necessary for the Improved Building Permit Process

For the improved building permit process, the following equipment will be required.

One (1) computer and one (1) printer to record the issued building permits allowing a digital record for future control.

CHAPTER II:

GENERAL MANUAL OF THE IMPROVED BUILDING PERMIT SYSTEM

2.1 FLOW CHART OF IMPROVED BUILDING PERMIT PROCESS

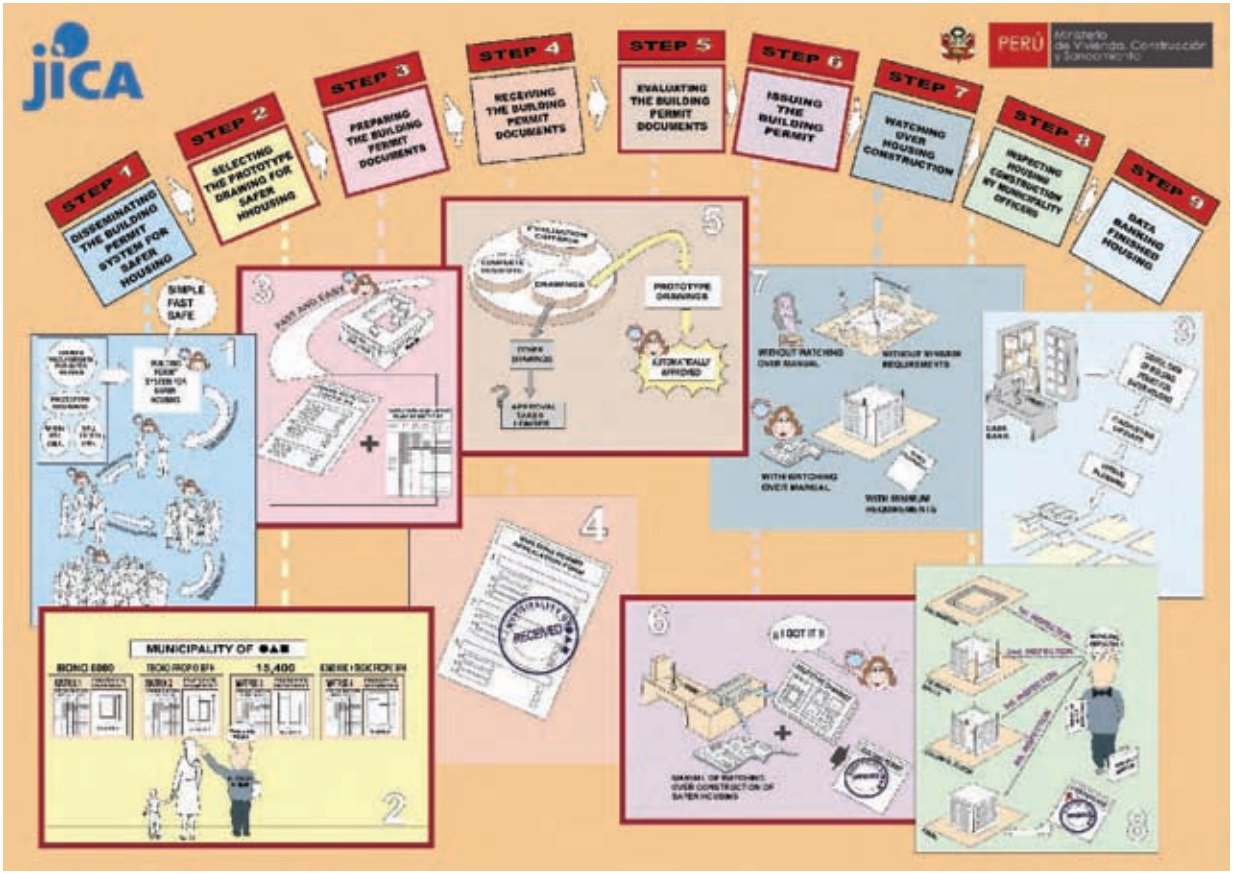


Figure 2.1 Flow Chart of Improved Building Permit Process

Source) Study on Housing Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

Detailed steps shown in the flow chart are described in the next chapter.

2.2 POINTS TO BE CONSIDERED AT EACH STEP OF THE PROCESS

STEP 1: Disseminating of Improved Building Permit System

- The dissemination of the improved building permit system guides those who will reconstruct their houses, in the application of the building permit more simply, easily and safely.

STEP 2: Selecting the Prototype Drawings for Safer Housing

- The Project Bank conformed by the prototype drawings will allow the applicants to select a safer housing model according to their affordability and needs.
- Municipality officer will widely inform to the applicants about the merits and characteristics of the distinct types of prototype drawings, in order make them satisfied with the selection.
- For the prototype drawing selection, type of soil will be taken into account. For this purpose, municipality officer should consult the respective district risk map.
- In the selection of prototype drawings Urban and Building Parameters of the district should be taken into account, to locate the housing in the respective lot.

STEP 3: Preparing the Building Permit Application

- Once the applicants make the proper selection of the prototype drawings, building permit application will be prepared considering all requisites according to the regulation. This process is fast and safe because the owner already have the previously approved prototype drawings

STEP 4: Receiving the Building Permit Application

- Municipality officer receives the necessary application documents, according to TUPA requirements

STEP 5: Evaluating the Building Permit Documents

- In case the applicants use prototype drawings, land title document will be firstly verified, and then building permit will be automatically issued.

The required documents listed below, will be evaluated:

1 Application form
2 FUO Part 1
3 Land title or Property certificate issued by the Public Registration Office
4 Application fee certificate
5 Prototype Drawings for Saber Housing

STEP 6: Issuing the Building Permit

- Once the documents are reviewed and accepted, a building permit number will be registered in the application annexed to the prototype drawings and the manual of watching over construction of safer housing. Respective payment will be in accordance to the Municipality TUPA.

STEP 7: Watching over House Construction by the House Owner

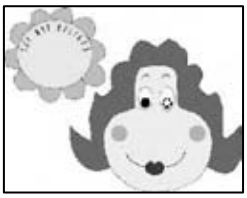
- Owners with approved building license should use the manual of watching over construction of safer housing, to watch if the mason works according to the minimum requirements for a safer housing, according to the prototype drawings.
- If the manual of watching over is not used, the quality of house construction could be lower, compromising the safety of the constructed housing as well as of its occupants.

STEP 8: Inspecting House construction by Municipality Officer

- Timely inspection by a municipality officer contributes to the proper construction of the main members (foundation, beams, columns, walls and roofing), obtaining so a safer housing, with good quality construction.
- It is very important to program and implement periodical inspections in the stages of foundation, walling, roofing and at the work completion.

STEP 9: Data Banking of Completed Houses

- Data banking is a tool which allows the district municipality to keep a data bank of all issued building permits. Information collected from the issued building permits will allow the cadastre updating and also can be used for a city urban planning.



CHAPTER III: MANUAL STEP BY STEP

3.1 STEP 1: DISSEMINATING THE IMPROVED BUILDING PERMIT SYSTEM

The dissemination of the improved building permit system for safer housing has to emphasize the positive characteristics of this system. They indicate that the system is **Fast, Simple and Safe**.

The most important components as well as the dissemination method of the system are explained as follows.

(1) Safer Housing

Definition of safer housing

A safer housing is the one that provides to its occupants the adequate safety conditions. In order to achieve said conditions, housing design has to consider important aspects such as: proper location, rational architectural and structural designs, constructed by skilled workers and counting with professional guidance during construction.

Necessity of safer housing

It is well known that most constructions in Peru are informally built, in a manner that the aspects to get a safer house are not fulfilled. Consequently, housings are unsafe, putting the lives of the inhabitants into danger.

The importance to have a safer housing is mainly to safeguard the lives of its occupants.

Relation of minimum requirements and safer housing

Minimum requirements for safer housing are the basic technical guidelines for the design, construction and inspection of a safer housing. As mentioned in the first chapter, the minimum requirements were prepared based on information validated by authorized institutions in the sphere of national construction. Therefore, the good application would conduct to the construction of a safer housing.

(2) Improved Building Permit System

The following elements are introduced into the existing building permit process to facilitate the administration. All of them were prepared in conformity with the minimum requirements.

Manual of Improved Building Permit for Safer Housing

- A manual of improved building permit for safer housing very easy to understand is provided together with prototype drawings, manual of watching over construction, and manual of simple inspection; that are explained below.

Prototype Drawings

- Building permit is automatically issued.
- Safer housing is considered.

Manual of Watching over Construction of Safer Housing

- Guideline for the owner so he/she can watch over the construction of a safer housing.
- It is a practical manual and easy to understand.

Manual of Simple Inspection for Construction of Safer Housing

- Safer housing can be built, by following the steps established in the manual.
- The municipality officer counts on with a simple and practical guide, easy to understand.
- Once the fourth inspection is finished, the Final inspection certificate is issued by the owner's request.

(3) Building Permit Statistics

- It allows a district municipality to count on with a record to show how many houses have been constructed with approved documents, updating the cadastre.
- It allows to municipality to increase revenue due to tax payment, for the updated cadastre allows to corroborate the constructed areas.

(4) Dissemination Means

- Leaflet
- Poster
- Manual

3.2 STEP 2: SELECTING THE PROTOTYPE DRAWINGS

(1) Characteristics of Prototype Drawings for Safer Housing

Prototype drawings for safer housing are a complete set of drawings including architectural, structural, electrical and sanitary installation, for the construction of confined masonry housing. The drawings have been prepared under the construction regulations in force in Peru.

Diversity of Prototype Drawings

Important factors of the prototype drawings for safer housing which determined the design and cost of the same are as follows:

- Type of bonus for housing reconstruction
- Type of soil
- Availability for electric service
- Availability of sanitary service

All prototypes derived from the above-mentioned factors cover the following amounts.

Prototype 1 (BONO 6000)	= S/. 6 000.00
Prototype 2 (Techo Propio BFH)	= S/. 13 400.00
Prototype 3	= S/. 15 400.00
Prototype 4 (BONO 6000 + Techo Propio BFH)	= S/. 19 400.00

(2) Process for Selecting the Prototype Drawings

Floor plans of prototype drawings were designed taking in consideration two factors; one factor was the construction cost and the other was the toilet location. Floor area is based on the type of housing reconstruction bonus. Location of toilet can be inside or outside the house.

The selection of prototype drawings is as follows.

First, floor area will be selected according to the owner's affordability. Second, location of toilet will be selected according to the sanitary conditions of land location.

Third, a matrix for selection of prototype drawings is used. The matrix shows the selection factors of prototype drawings such as type of foundation, type of roofing, availability of electrical installation and availability of sanitary installation, according to the type of bonus. The foundation will be decided by the type of soil. Roofing will consider the owner's intentions about future vertical expansion. Electrical and sanitary installations will be decided by the availability of said services in the owner's land.

Finally, the complete set of drawings will be selected, according to the matrix for prototype drawings selection. See Annex 3..

In order to show the process of selecting the prototype drawings for safer housing, a simple example of how people who wants to build a house can select one out of many drawings, is presented below.

History of Juanita

Juanita Pelayo is a woman affected by the earthquake. The house which she and her three children had lived collapsed because it was an adobe house built badly. After the earthquake she received the BONO 6000 to reconstruct the house for her and her family.

Juanita, wishing to have soon a safe place to protect her family, goes to the district municipality. Municipality officers indicate her that she has to go to the public works office. Once there the officer says to her:

Eng. Goycochea: Good afternoon lady. I am an engineer Goycochea . How can I help you?

Juanita: Good afternoon engineer. I am Juanita Pelayo. I want to rebuild my house with the BONO given by the government. Unfortunately, I do not have money to prepare drawings or any of such things. What should I do?

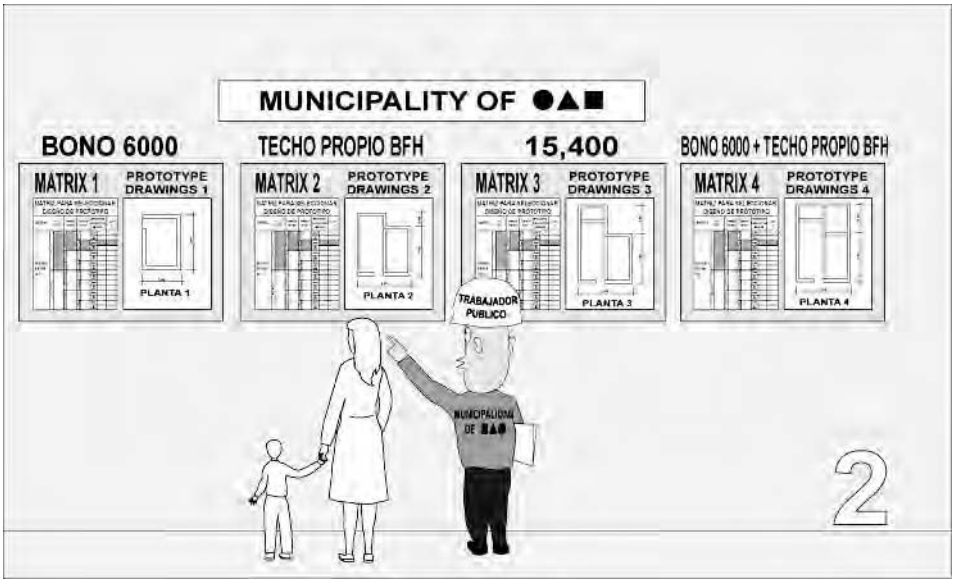
Ing. Goycochea: Ms. Juanita, as you do not have drawings, we in the municipality can provide you with some drawings that have been already approved. So you can use them to build a safe house.

Juanita: How good engineer! Would you show me the drawings? How can I get them?

Ing. Goycochea: Yes, I will show you. But first I will show you a little chart that helps you to determine which design is the best for you, because we have many drawings and it is necessary to select the one that adjusts to your needs best, Mrs. Juanita.

Juanita: All right engineer, show me the chart.

(Engineer Goycochea, leads Juanita to an area in his office where the four matrix hanging in the wall and asks Juanita some questions in order to select the adequate drawing for her.)



Source) Study on Housing Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

(Engineer Goycochea Takes Juanita to a zone in the office where four matrixs of selection of prototype drawings are shown on the wall, and asks her some questions in order to select the adequate drawings for her.)

Ing. Goycochea: Mrs. Juanita, What type of bonus do you have? Besides the bonus, do you have any savings to reconstruct your home?

Juanita: I have the BONO 6000, but unfortunately I do not have any more money to build my house. But in the future, I will go on with the construction to build more rooms for my little children.

Eng. Goycochea: Very well Mrs. Juanita. Then, let's see the first chart that corresponds to BONO 6000. Now tell me, do you know if the soil where you lived is good or sandy or weak?

Juanita: Yes, engineer! A lot of sand and the houses of my neighbors were cracked even before the earthquake. All said that the soil was sandy and that is why there were cracks.

Eng. Goycochea: All right. Don't worry because your future house will have proper foundations to sandy soil and will not crack as your neighbors' houses. Now tell me, do you have electric and sanitary services?

Juanita: We have sanitary service but still there is not electric service. We wish they install electric power so my children can ready at night without prejudice to their vision because they read with candle lights. But, why do you ask me about electrical and sanitary services, engineer?

Eng. Goycochea: Because, Mrs. Juanita, here we have a complete set of drawings, with electrical and sanitary installation drawings. According to the public service you have in your zone, we can tell you how much your house will cost. For exemple, let's see with the information you gave me....

(Engineer Goycochea see the first chart and according to what Juanita told him, he identifies the cost and the prototype drawings that correspond to her.)

Here it is Mrs. Juanita, this prototype corresponds to your conditions. The construction cost of your house is within your budget. Put it briefly, this prototype corresponds to price of BONO 6000, bad soil condition, sanitary installation but no electrical installation. Your house has 16 m^2, but this prototype allows future expansion to build rooms for your children. Exactly what you want! What do you think, Mrs. Juanita?

Juanita: It is ideal for me, engineer. And I like it very much because I can enlarge my house little by little to have it as I always wished. But, engineer,.. now that I have the drawings, What else should I do to get my Building Permit?

Ing. Goycochea: This is still easier Mrs. Juanita, let's go back to the office and I will tell you how easy it is to get the license in this Municipality.

Juanita: How good, engineer. I thought that it would take a lot of time. How nice, thank you very much, let's go then, so you can indicate me what else I have to do.

(Engineer Goycochea and Juanita go on talking about the other requirements to get the Building Permit for Safer Housing)

Juanita: Yes, the easier and faster the better because I have to go back and prepare lunch for my children, engineer.

(3) Conditions of Prototype Drawings Applicability for the Applicants

Besides the prototype drawings, additional documents are required to be submitted, in order to obtain the building permit: application form of the building permit, land title, location plan and application fee certificate. All refers to the requirements which the municipality demands to building permit applicants, according to the TUPA.

Since prototype drawings for safer housing are oriented towards the use of subsidies granted by the State, the conditions adjusting for their use would be:

- To have a subside bonus (BONO 6000, Techo Propio BFH or both)
- Be owner of the land to build the house (area range of prototype drawings for safer houses are from 16.38m^2 to 53.13m^2)

- Soil that does not show an extreme configuration such as swampy or with the underground water level too high. The land may not be in gullies, non habilitated area, dumpers, flooding areas, landslide areas and others.
- To know the availability of public services at the construction zone (electric and sanitary installations)

3.3 STEP 3: PREPARING A BUILDING PERMIT APPLICATION

(1) Building Permit Documents

According to Law Nº 27157, the applicants will submit the following documents.

Table 3.1 Required Documents for Building Permit

1	Procedure sheet for application
2	FUO (single official form) Part 1
3	Land title or Property certificate issued by the Public Registration Office
4	Application fee certificate
5	Prototype drawings

Source) Study on Housing Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

- The procedure sheet and FUO Part 1 will be requested at the Municipality to be filled out by the applicant, with the support of the municipality office when required.
- Registered land title to request at the Public Registration Office
- Architectural, structural, electrical and sanitary installation drawings will be provided at the municipality project bank, that are previously approved and do not require the signature of a professional.

3.4 STEP 4: RECEPTION OF THE BUILDING PERMIT APPLICATION

Source) Study on Housing Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

(1) Reception of Documents

- Reception place: an officer of the technical office of the municipality verifies if the documents are complete, according to the TUPA.

  In case they are not complete, the documents will be given back to the applicant to be completed and submitted again, according to the regulation in force.

- The municipality officer will explain to the applicant all the next steps of the process up to the end. Also she/he will solve all the questions

made by the applicant on the matter.

(2) Documents Record

- Once the documents pass the verification, they will be registered with a document file number. Payments will be according to the TUPA.

3.5 STEP 5: BUILDING PERMIT EVALUATION

Documents will be sent by the reception desk to the Technical Office one day after the reception, at most.

(1) Evaluation criteria for each item

- Documents contents should coincide with the legislation in force.
- The land area declared in the documents should correspond to the area registered at the land title
- Land should not have tax debts unpaid fines. If it it so, the creditor must authorize the process
- In case of necessity, prototype drawings should be adapted to the owner's land, with the collaboration of the municipality.
- The applicant should indicate the construction starting date, for the inspection scheduling.
- The documents with drawings of the project bank will be accepted after verifying the owner signature in said drawings.

3.6 STEP 6: ISSUING THE BUILDING PERMIT

After the documents are approved, the municipality officer will issue a resolution authorizing the housing construction establishing the construction area, providing the corresponding building permit register number at the form. Also, the corresponding address numbering of the housing will be provided.

Additionally to the prototype drawing and the building permit, the municipality will provide to the owner the Manual of watching over construction for safer housing.

The municipality officer in charge of the building permit issue, will confirm with the owner the construction starting date and provide the inspection schedule.

The owner is requested to take copies of the building permit documents (Application form and drawings) that have to be at the construction, in order to make the control easier.

3.7 STEP 7: WATCHING OVER HOUSE CONSTRUCTION BY THE HOUSE OWNER

For the watch over the house construction, the house owner shall use the manual of watching over construction of safer housing as a separate document, to be provided by the municipality officer together with the Building permit.

Source) Study on Housing Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

(1) Objective of the Manual

The objective of the present manual is to provide the key necessary knowledge to the one who will reconstruct the house, about the following procedures step by step in order to get a safer housing, by using the selected prototype drawing. The key points correspond to the minimum requirements for safer housing.

(2) Instructions to use the manual

This manual will be used for the house owner to watch over the construction made by mason. The watch over is carried out according to the minimum requirements corresponding to the construction of safer housing.

This manual can be used in a practical way because it contains many illustrations, allowing the owner to be familiar with the appropriate construction process. By taking a look at the illustrations of the manual, it can be clearly visualized if the works are being done properly or improperly.

As example the house owner observes the foundation. The manual indicates the depth and width of the foundation which shall be excavated.

Consequently, the house owner can easily identify the mistakes when they occur. In this way, the house owner can watch over the most important works of construction very quickly and easily, contributing to the construction of a safer housing.

(3) Measures to be taken in case of mistakes

The house owner may find construction mistakes in the house construction, following the manual illustrations.

For example, if the house owner finds that the foundation excavation is less deeper than the one shown in the manual illustrations, the owner can ask the mason to excavate the foundation deeper and wider; if the mason does not install the proper anchoring for the wall and column as confinement, the owner can indicate to the mason to set them properly. With the help of the manual the house owner can find the mistakes at the proper timing.

For that reason, the owner must check the house construction by using the manual, indicating to the mason the mistakes every time they occur, so they can be corrected.

3.8 STEP 8: INSPECTING HOUSE CONSTRUCTION BY MUNICIPALITY OFFICER

For the Inspection of house construction, a municipality inspector shall use the manual of simple inspection for construction of safer housing.

(1) Items for construction inspection

(Check list for simple inspection)

Instructions to fill in the check list

- The check list of construction inspection is prepared to be filled in a fast and simple way. The directions on how to read and understand the check list are explained below.

- Firstly, a municipality inspector shall read the items of inspection activities or construction stages shown in the list.
- Then, the inspector shall read the detailed description of each inspection activity or construction stage.
- Next, the inspector shall see the illustration of the minimum requirements works to identify the inspection item simply and fast. The inspector carries out inspection of the corresponded work using the minimum requirements as an evaluation tool.
- Finally, the inspection result can be marked after inspection.

By using the check list, the inspector will avoid forgetting important inspection points.

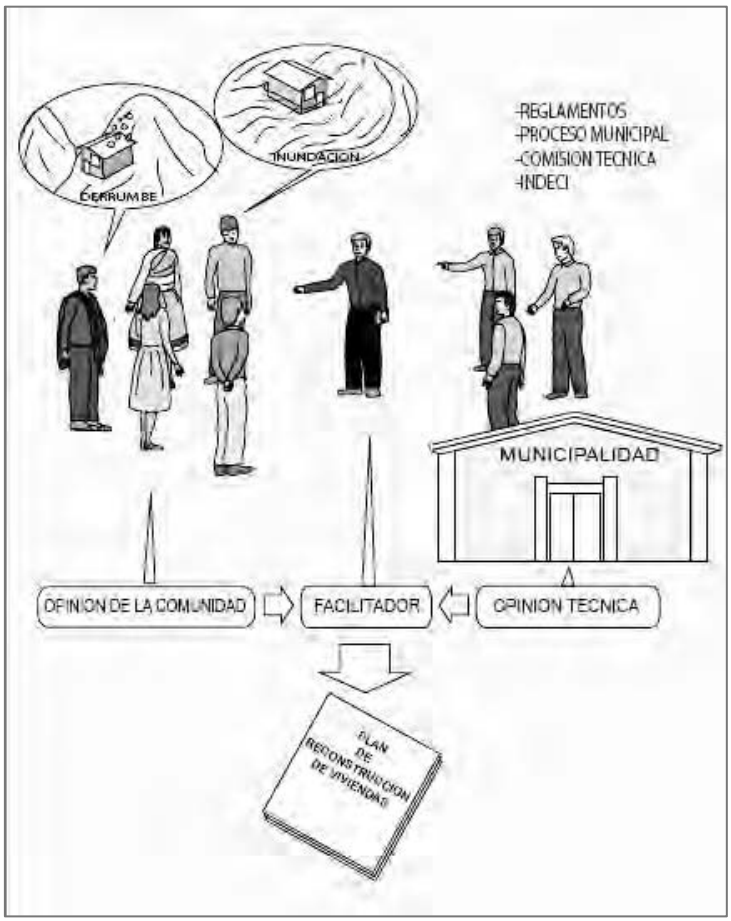
The municipal inspector can also record any observation in case of construction mistakes. Such observations shall be immediately informed as warning to the house owner and the construction artisan so they can take the necessary corrective measures. At the next inspection, it is checked whether corrective measures were taken or not.

If the correction were not executed, at the second visit the municipal inspector shall inflict a penalty to the house owner and a warning to the construction artisan for not responding to the warning, according to the regulation in force.

Evaluation of the inspection results

After filling the results of inspection into the check list properly, the inspector will write the comments on the corresponding space at the check list.

If the observations are not corrected, the regulation in force will be applied.



Source) Study on Housing Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

(2) Certificate of Completion of Works

This certificate of completion of works can be obtained once the construction is finished and if the house owner so requests. With this document it will be possible to begin with the Procedures for the Statement of a Construction Work Legal Existence.

Instructions for filling in the certificate of completion of works

The Certificate of Completion certificate will have the following information:

- Certificate identification number (according to the municipality register)
- Number of building permit documents file and building permit number
- Number of the reports of inspections conducted
- Name of the land owner
- Location of the land
- Signature and seal of the officer in charge of works

3.9 STEP 9: DATA-BANKING OF COMPLETED HOUSES

(1) Data Base Form

The following information and data are obtained from the building permit documents.

- Owner's full name and/or legal name
- Location of the constructed house
- Information of the property (area, level and shape of the land)
- Technical specifications of the house
- Construction cost of the house
- Number of buildings
- Number of stories
- Type of structures
- Conditions of electric service
- Conditions of water and sewerage service
- Soil condition
- Zoning

(2) Practical Use of Data

The information and data obtained from building permit will be useful to update the cadastre and also to plan the ordained city development

BUILDING PERMIT USEFUL DATA						
ITEM	APPLICANT'S FULL NAME	DOCUMENT FILE	PROTOTYPE NUMBER	HOUSING LOCATION	CONSTRUCTED AREA	AMOUNT OF WORKS
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

APPENDIX A: APPLICATION FORMS AND PAMPHLETS

Appendix A1: Flow Chart of the Improved Building Permit System

Appendix A2: Minimum Requeriments for Safer Housing

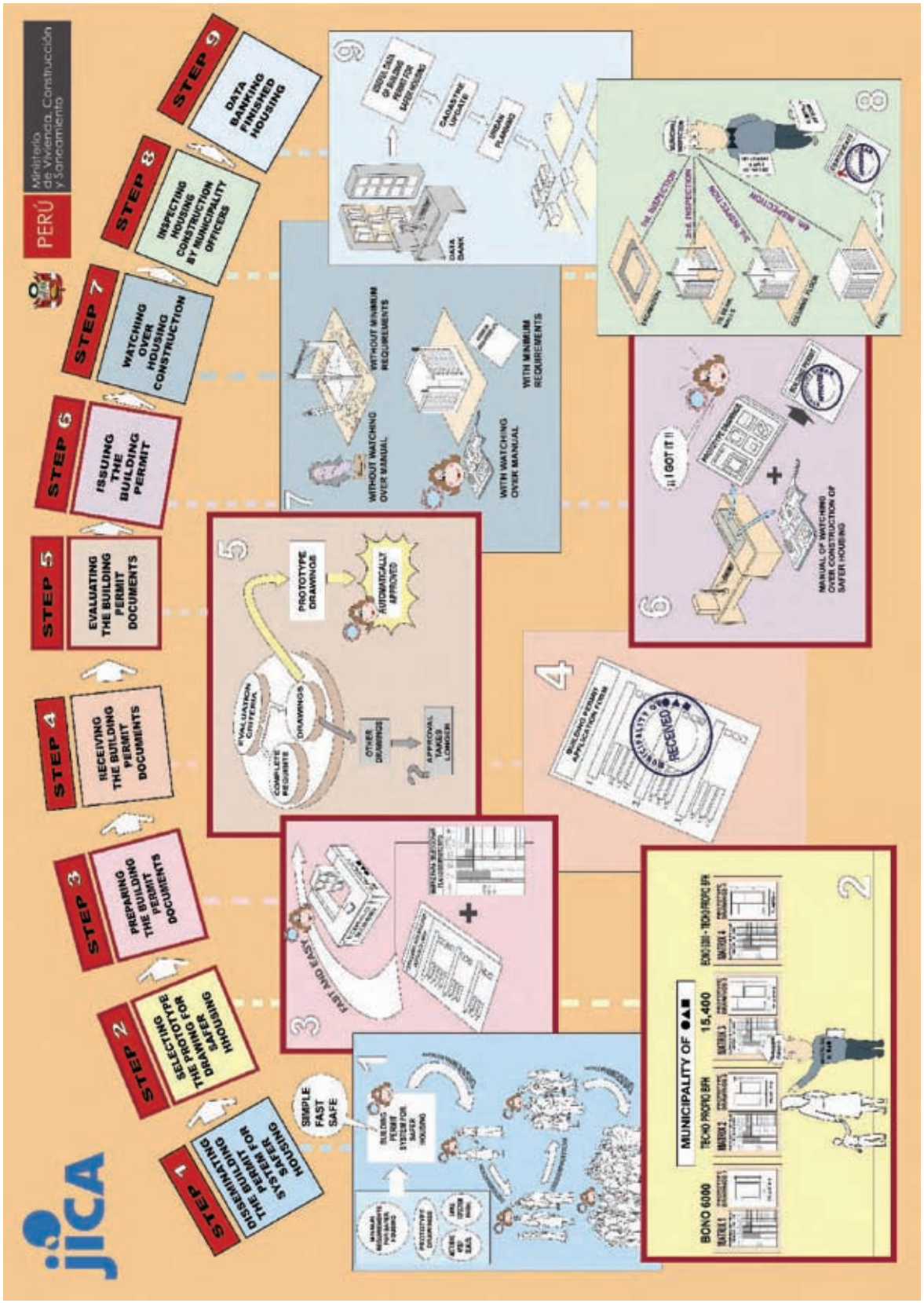
Appendix A3: Matrix for the selection of Prototype Drawings for Safer Housing

Appendix A4: Prototype Drawings for Safer Housings

Appendix A5: Table of Contents of the Manual of Watching Over Construction of Safer Housing

Appendix A6: Table of Contents of the Manual of Simple Inspection for Safer Housing

Appendix A1: Flow Chart of the Improved Building Permit for Safer Housing



Source) Study on Housing Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

Appendix A2: Minimum Requirements for Safer Housing

MINIMUM REQUIREMENTS FOR SAFER HOUSING

The Minimum Requirements are established in conformity with
Peruvian National Building Code

JICA Study Team

1. Quality of Materials
2. Structural Section of Main Members
3. Connection of Structural Members

1. Quality of Materials

1.1 Concrete

a) Mixture design for reinforced tie beam is one (1) portion of Portland cement, two (2) portions of clean coarse sand, four (4) portions of crushed stone (the size is less than 1/2") and one (1) portion of clean and drinkable water. Mixture design for non reinforced tie beam is one (1) portion of Portland cement, eight (8) portions of hormigon, two and half (2.5) portions of medium stones (the size is maximum 4") and one and quarter (1.25) portions of clean and drinkable water.

Mixture design for confined columns, ring beams and light slab is one (1) portion of Portland cement, two (2) portions of clean coarse sand, three (3) portions of clean crushed stone (the size is less than 1/2") and one (1) portion of clean and drinkable water.

In case of salty soil for foundation, vinyl sheet is used to prevent salt damage of concrete.

b) Materials are well mixed where the aggregate is not visible and poured to form work immediately.
c) Form work is hard and no bleeding.
d) Any gaps and void is avoided by using a stick to compact concrete when it is pouring.

1.2 Mortar

Mixture design is one (1) portion of Portland cement and four (4) portions of clean coarse sand.

1.3 Foundation

Mixture design for foundation is one (1) portion of Portland cement, ten (10) portions of hormigon, one and half (1.5) portions of clean and drinkable water and three (3) portions of large stones (the size is maximum 10")

Hormigon is composed of gravel and coarse sand directly obtained from quarry place

1.4 Wood

Wood is hard, dry, dense fiber, well cured, no crack and straight.

1.5 Brick

Brick is burned and orange color without white pale shadow. Brick is also dust free, without cracks or bending.

1.6 Water

Water is clean and drinkable.

2. Structural Section of Main Members

Wall of confined masonry house is enclosed firmly with reinforced concrete tie beam, reinforced concrete column and reinforced concrete ring beam on a stable foundation with enough strength. Every vertical part of wall corner is firmly connected, forming confined elements.

2.1 Foundation

Foundation width and height is 60 cm or more. In case of the foundation without loads from small beams of roofing, the width of foundation can be 50 cm. Foundation depth is no less than 80 cm.

2.2 Sections of reinforced concrete member

a) Tie beam width is 13 cm or 24 cm according to the width of the wall. The minimum height is 50 cm. Tie beam is reinforced with four (4) steel bars of 3/8" diameter, with stirrups of 1/4" diameter at 20 cm intervals. If the soil is mainly composed of slime and/or sand, the tie beam is needed to be reinforced.

b) Maximum wall area framed with tie beam, column and ring beam is 12.0 m2. The maximum height of the wall is 2.4 m.

c) Column has a minimum section of 13 cm wide and 15 cm high, and four (4) steel bars of 3/8"diameter are placed with hoops of 1/4" diameter. Five (5) hoops are placed from the connection point with tie beam. First hoop is placed at 5 cm from the connection point. The other four (4) hoops above the first hoop are placed at 10 cm interval. Another five (5) hoops are placed from the point with ring beam as the same case from the connection of tie beam. At the rest space of column hoops are placed at 25 cm interval.

   Additionally, two (2) stirrups are placed in joint of column and ring beam at 10 cm interval. Three (3) stirrups are also placed in joint of column and tie beam at 15 cm interval.

d) Minimum dimension of ring beam is 13 cm wide and 20 cm high, and four (4) steel bars of 3/8"diameter are placed with stirrups of 1/4" diameter. Five (5) stirrups are placed from the connection point with column. First stirrup is placed at 5 cm from the connection point. The other four (4) stirrups beside the first stirrup are placed at 10 cm interval. Another five (5) stirrups are placed from the connection point with the other column as the same case from the connection of the other above mentioned column. At the rest space of ring beam space stirrups are placed at 25 cm interval.

e) Minimum covering depth of concrete is 2 cm for walls with finish and 3 cm for walls without finish. In case of foundation, covering depth is 7.5 cm.

f) Minimum length of structural wall is 1.2 m.

2.3 Maximum span

Maximum span of columns is 5.0 m in case of 24 cm wide wall. It is 3.5 m in case of 13 cm wide wall.

3. Connection of Structural Members

3.1 Anchor of column to tie beam and ring beam

Four (4) steel bars of column anchored to the foundation. The steel bars bend 90° at 7.5 cm from the bottom of foundation. The bended steel bars are prolonged 25 cm. In case of reinforced tie beam, the steel bars of column and tie beam must be carefully tied by steel wires to ensure an adequate connection between these structural elements. In case of good soil, concrete without reinforcement is used.

In the same way, four (4) steel bars of column anchored to reinforced ring beam. The steel bars bend 90° at 2 cm from the top of ring beam. The bended steel bars are prolonged 25 cm measured from the column surface.

3.2 Connection of wall and column

There are two connection methods. One is that joint between wall and columns is geared and the length of the salient part of brick does not exceed 5 cm. The other is that two (2) steel bars of 1/4" diameter anchor at every four (4) layers of wall bricks at least 40 cm inside masonry and 12.5 cm inside column with vertical turning of 90° at 10 cm.

3.3 Overlapping of reinforcements

Steel bars of reinforced concrete overlap at least at 40 cm.

3.4 Wall joint mortar thickness

Thickness of joint mortar for wall is from 1.0 to 1.5 cm.

Appendix A3: Matrix to the selection of prototype drawings for safer housing

MATRIX OF PROTOTYPE Nº 1

PROJECT: STUDY OF RECONSTRUCTION OF SEISMIC-RESISTANT HOUSING IN THE REPUBLIC OF PERU
LOCATION: PUEBLO NUEVO - LA TINGUIÑA - INDEPENDENCIA

CONSTRUCTION AREA		KIND OF SOIL / FOUNDATION		KIND OF ROOF	ELECTRICAL INSTALLATIONS	KIND OF SANITARY INSTALLATIONS	CODIFICATION	COST S/.	COST S/. INCL. IGV
		CHARACTERISTICS	FOOTING						
PROTOTYPE 1 BONO 6000	AREA 16.38 m2	REGULAR RESISTANCE GRANULAR MATERIAL WITH COBBLES OF SMALL TO BIG STONES σAcceptable soil 1.2 @ Mas/kg/cm2	SIMPLE	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 01	6,848.19	8,149.35
						WITHOUT LATRINE	PROTOTYPE 1 No. 02	5,900.64	7,021.76
					NOT AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 03	6,417.08	7,630.38
						WITHOUT LATRINE	PROTOTYPE 1 No. 04	5,464.53	6,502.79
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 05	5,940.96	7,069.74
						WITHOUT LATRINE	PROTOTYPE 1 No. 06	4,993.42	5,942.17
					NOT AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 07	5,504.85	6,550.77
						WITHOUT LATRINE	PROTOTYPE 1 No. 08	4,557.31	5,423.20
		LOW RESISTANCE SAND OR CLAY WITHOUT COBBLES σAcceptable soil 0.8 @ 1.2 kg/cm2	REINFORCED	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 09	7,105.81	8,455.91
						WITHOUT LATRINE	PROTOTYPE 1 No. 10	6,158.27	7,328.34
					NOT AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 11	6,669.70	7,936.94
						WITHOUT LATRINE	PROTOTYPE 1 No. 12	5,722.16	6,809.37
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 13	6,198.59	7,376.32
						WITHOUT LATRINE	PROTOTYPE 1 No. 14	5,251.05	6,248.75
					NOT AVAILABLE	WITH LATRINE	PROTOTYPE 1 No. 15	5,762.48	6,857.35
						WITHOUT LATRINE	PROTOTYPE 1 No. 16	4,814.94	5,729.78

Matrix to the Selection of Prototype Drawings 1

MATRIX OF PROTOTYPE Nº 2

PROJECT: STUDY OF RECONSTRUCTION OF SEISMIC-RESISTANT HOUSING IN THE REPUBLIC OF PERU
LOCATION: PUEBLO NUEVO - LA TINGUIÑA - INDEPENDENCIA

CONSTRUCTION AREA		KIND OF SOIL / FOUNDATION		KIND OF ROOF	ELECTRICAL INSTALLATIONS	KIND OF SANITARY INSTALLATIONS	CODIFICATION	COST S/.	COST S/. INCL. IGV
		CHARACTERISTICS	FOOTING						
PROTOTYPE 2 TECHO PROPIO BFH 13400	AREA 35.47 m2	REGULAR RESISTANCE GRANULAR MATERIAL WITH COBBLES OF SMALL TO BIG STONES σ Acceptable soil 1.2 @ Mas/kg/cm2	SIMPLE	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	BATHROOM	PROTOTYPE 2 No. 01	13,727.94	16,336.25
						LATRINE	PROTOTYPE 2 No. 02	12,962.26	15,425.09
					NOT AVAILABLE	BATHROOM	PROTOTYPE 2 No. 03	13,058.15	15,539.20
						LATRINE	PROTOTYPE 2 No. 04	12,333.67	14,677.07
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	BATHROOM	PROTOTYPE 2 No. 05	11,876.87	14,133.48
						LATRINE	PROTOTYPE 2 No. 06	11,088.34	13,195.12
					NOT AVAILABLE	BATHROOM	PROTOTYPE 2 No. 07	11,207.07	13,336.41
						LATRINE	PROTOTYPE 2 No. 08	10,459.75	12,447.10
		LOW RESISTANCE SAND OR CLAY WITHOUT COBBLES σ Acceptable soil 0.8 @ 1.2 kg/cm2	REINFORCED	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	BATHROOM	PROTOTYPE 2 No. 09	14,238.98	16,944.39
						LATRINE	PROTOTYPE 2 No. 10	13,440.14	15,993.77
					NOT AVAILABLE	BATHROOM	PROTOTYPE 2 No. 11	13,569.19	16,147.34
						LATRINE	PROTOTYPE 2 No. 12	12,811.55	15,245.74
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	BATHROOM	PROTOTYPE 2 No. 13	12,387.90	14,741.60
						LATRINE	PROTOTYPE 2 No. 14	11,566.23	13,763.81
					NOT AVAILABLE	BATHROOM	PROTOTYPE 2 No. 15	11,718.11	13,944.55
						LATRINE	PROTOTYPE 2 No. 15	10,937.64	13,015.79

Matrix to the Selection of Prototype Drawings 2

MATRIX OF PROTOTYPE Nº 3

PROJECT: STUDY OF RECONSTRUCTION OF SEISMIC-RESISTANT HOUSING IN THE REPUBLIC OF PERU
LOCATION: PUEBLO NUEVO - LA TINGUIÑA - INDEPENDENCIA

CONSTRUCTION AREA		KIND OF SOIL / FOUNDATION		KIND OF ROOF	ELECTRICAL INSTALLATIONS	KIND OF SANITARY INSTALLATIONS	CODIFICATION	COST S/.	COST S/. INCL. IGV
		CHARACTERISTICS	FOOTING						
PROTOTYPE 3 S/. 15400	AREA 43.23 m2	REGULAR RESISTANCE GRANULAR MATERIAL WITH COBBLES OF SMALL TO BIG STONES σ acceptable soil 1.2 @ Mas/kg/cm2	SIMPLE	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	BATHROOM	PROTOTYPE 3 No. 01	17,371.36	20,671.92
						LATRINE	PROTOTYPE 3 No. 02	16,458.16	19,585.21
					NOT AVAILABLE	BATHROOM	PROTOTYPE 3 No. 03	16,611.29	19,767.44
						LATRINE	PROTOTYPE 3 No. 04	15,733.53	18,722.90
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	BATHROOM	PROTOTYPE 3 No. 05	14,591.30	17,363.65
						LATRINE	PROTOTYPE 3 No. 06	13,799.57	16,421.49
					NOT AVAILABLE	BATHROOM	PROTOTYPE 3 No. 07	13,801.23	16,459.16
						LATRINE	PROTOTYPE 3 No. 08	13,074.94	15,559.18
		LOW RESISTANCE SAND OR CLAY WITHOUT COBBLES σ acceptable soil 0.8 @ 1.2 kg/cm2	REINFORCED	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	BATHROOM	PROTOTYPE 3 No. 09	18,014.27	21,436.98
						LATRINE	PROTOTYPE 3 No. 10	17,046.25	20,285.04
					NOT AVAILABLE	BATHROOM	PROTOTYPE 3 No. 11	17,254.20	20,532.50
						LATRINE	PROTOTYPE 3 No. 12	16,321.63	19,422.74
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	BATHROOM	PROTOTYPE 3 No. 13	15,234.22	18,128.72
						LATRINE	PROTOTYPE 3 No. 14	14,387.67	17,121.33
					NOT AVAILABLE	BATHROOM	PROTOTYPE 3 No. 15	14,474.15	17,224.24
						LATRINE	PROTOTYPE 3 No. 16	13,663.04	16,259.02

Matrix for the Selection of Prototype Drawings 3

MATRIX OF PROTOTYPE Nº 4

PROJECT: STUDY OF RECONSTRUCTION OF SEISMIC-RESISTANT HOUSING IN THE REPUBLIC OF PERU
LOCATION: PUEBLO NUEVO - LA TINGUIÑA - INDEPENDENCIA

CONSTRUCTION AREA		KIND OF SOIL / FOUNDATION		KIND OF ROOF	ELECTRICAL INSTALLATIONS	KIND OF SANITARY INSTALLATIONS	CODIFICATION	COST S/.	COST S/. INCL. IGV
		CHARACTERISTICS	FOOTING						
PROTOTYPE 4 BONO 6000 + TECHO PROPIO BFH 13400	AREA 53.13 m2	REGULAR RESISTANCE GRANULAR MATERIAL WITH COBELES OF SMALL TO BIG STONES σ Acceptable soil 1.2 @ Mas/kg/cm2	SIMPLE	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	BATHROOM	PROTOTYPE 4 No. 01	19,800.73	22,967.87
						LATRINE	PROTOTYPE 4 No. 02	18,305.15	21,890.23
					NOT AVAILABLE	BATHROOM	PROTOTYPE 4 No. 03	18,387.87	21,881.57
						LATRINE	PROTOTYPE 4 No. 04	17,523.49	20,852.95
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	BATHROOM	PROTOTYPE 4 No. 05	16,670.86	19,838.32
						LATRINE	PROTOTYPE 4 No. 06	15,802.38	18,804.83
					NOT AVAILABLE	BATHROOM	PROTOTYPE 4 No. 07	15,758.00	18,752.02
						LATRINE	PROTOTYPE 4 No. 08	14,930.72	17,767.56
		LOW RESISTANCE SAND OR CLAY WITHOUT COBBLES σ Acceptable soil 0.8 @ 1.2 kg/cm2	REINFORCED	VOIDED SLAB OF REINFORCED CONCRETE	AVAILABLE	BATHROOM	PROTOTYPE 4 No. 09	20,042.38	23,850.43
						LATRINE	PROTOTYPE 4 No. 10	19,081.97	22,707.54
					NOT AVAILABLE	BATHROOM	PROTOTYPE 4 No. 11	19,129.52	22,764.13
						LATRINE	PROTOTYPE 4 No. 12	18,210.31	21,670.27
				VOIDED ROOF WITH GUAYAQUIL CANE AND MUD CAKE	AVAILABLE	BATHROOM	PROTOTYPE 4 No. 13	17,412.51	20,720.89
						LATRINE	PROTOTYPE 4 No. 14	16,489.21	19,622.16
					NOT AVAILABLE	BATHROOM	PROTOTYPE 4 No. 15	16,499.65	19,634.58
						LATRINE	PROTOTYPE 4 No. 16	15,617.55	18,584.88

Matrix to the Selection of Prototype Drawings 4

Appendix A4: Prototype Drawings for Safer Housing

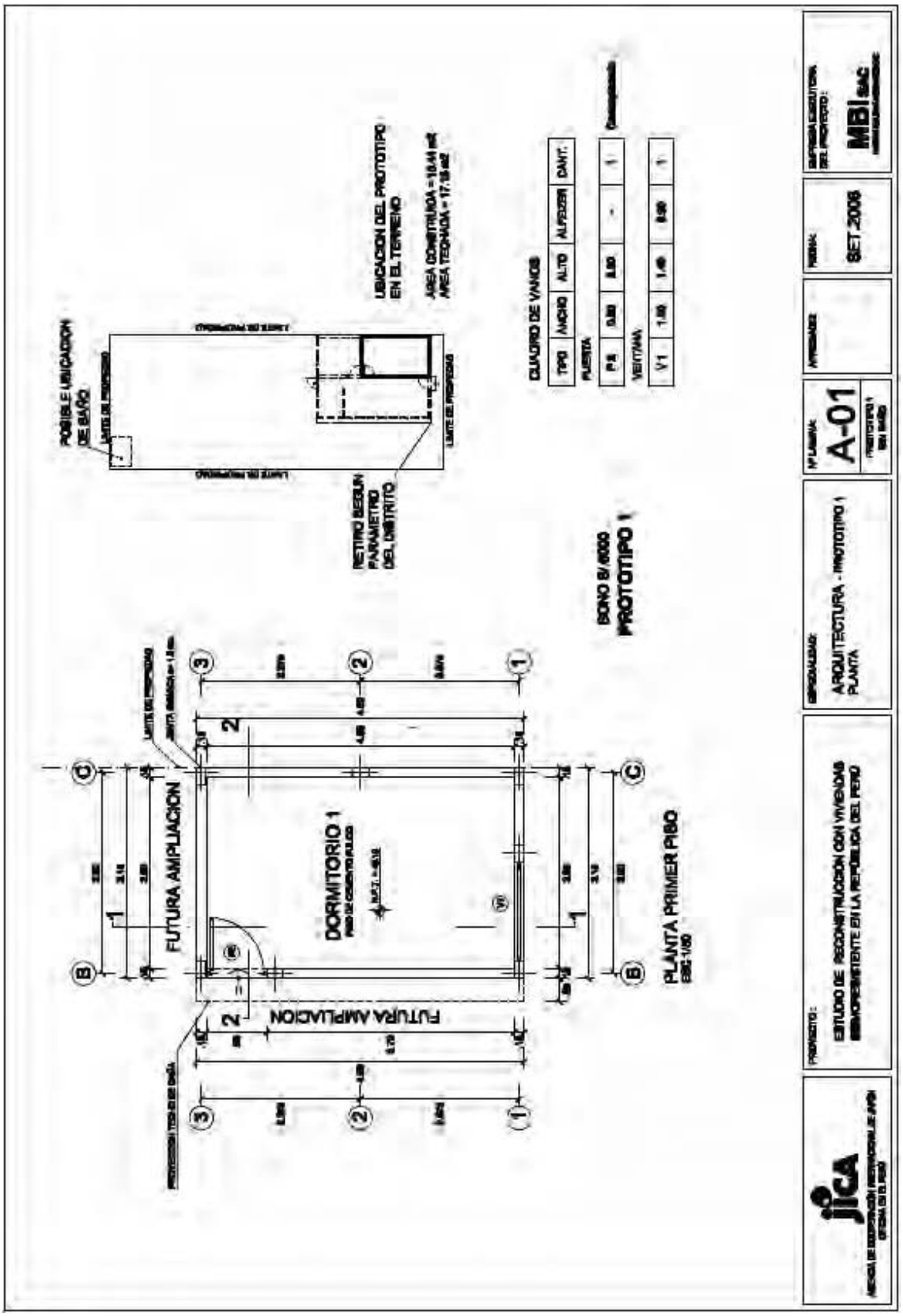
(1) Prototype 1 (BONO 6000)

(2) Prototype 2 (Techo Propio BFH) Toilet inside the house
(3) Prototype 2 (Techo Propio BFH) Toilet outside the house

(4) Prototype 3 (S/. 15,400) Toilet inside the house
(5) Prototype 3 (S/. 15,400) Toilet outside the house

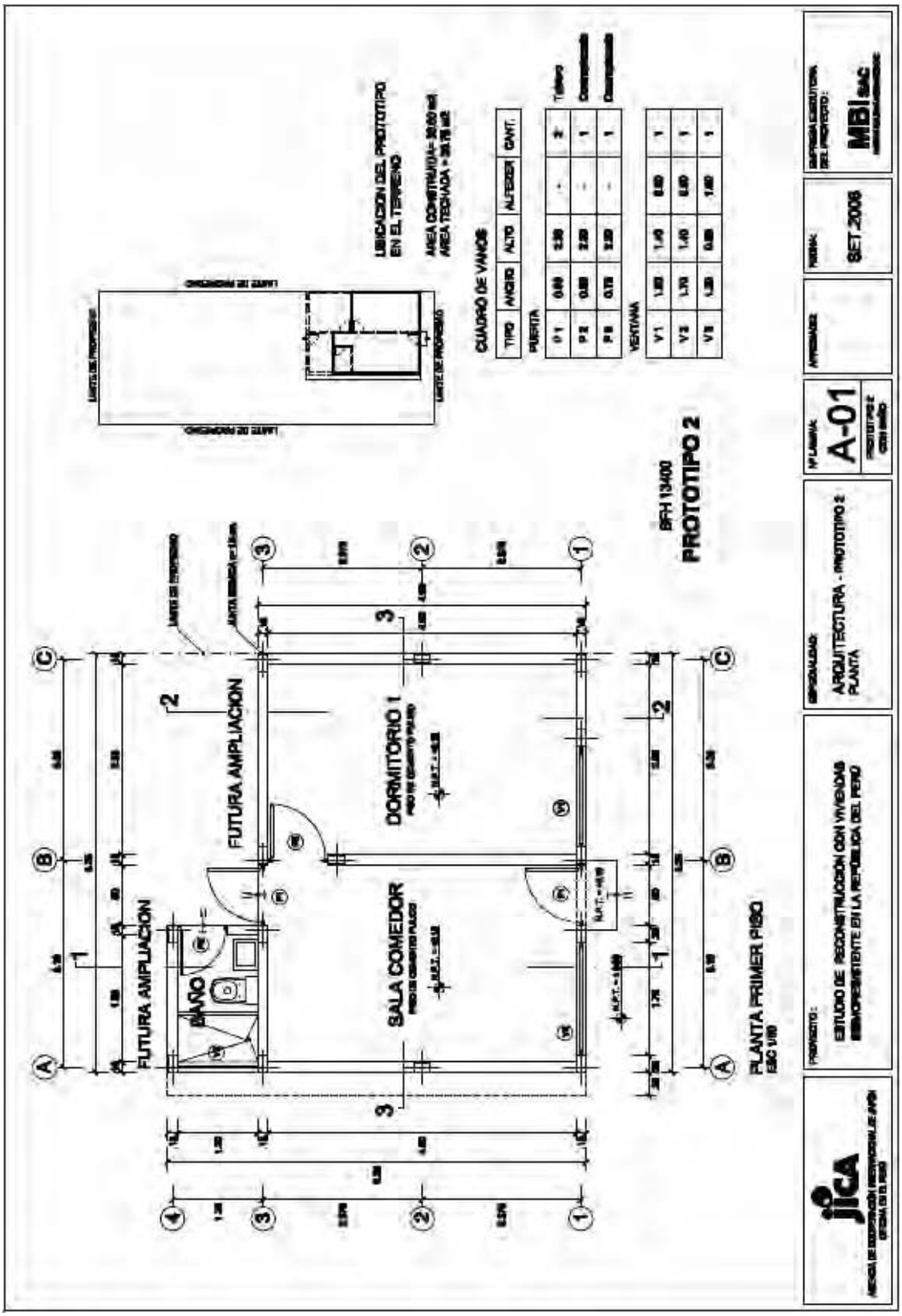
(6) Prototype 4 (BONO 6000 + Techo Propio BFH) Toilet inside the house
(7) Prototype 4 (BONO 6000 + Techo Propio BFH) Toilet outside the house

(1) Prototype 1 (BONO 6000)



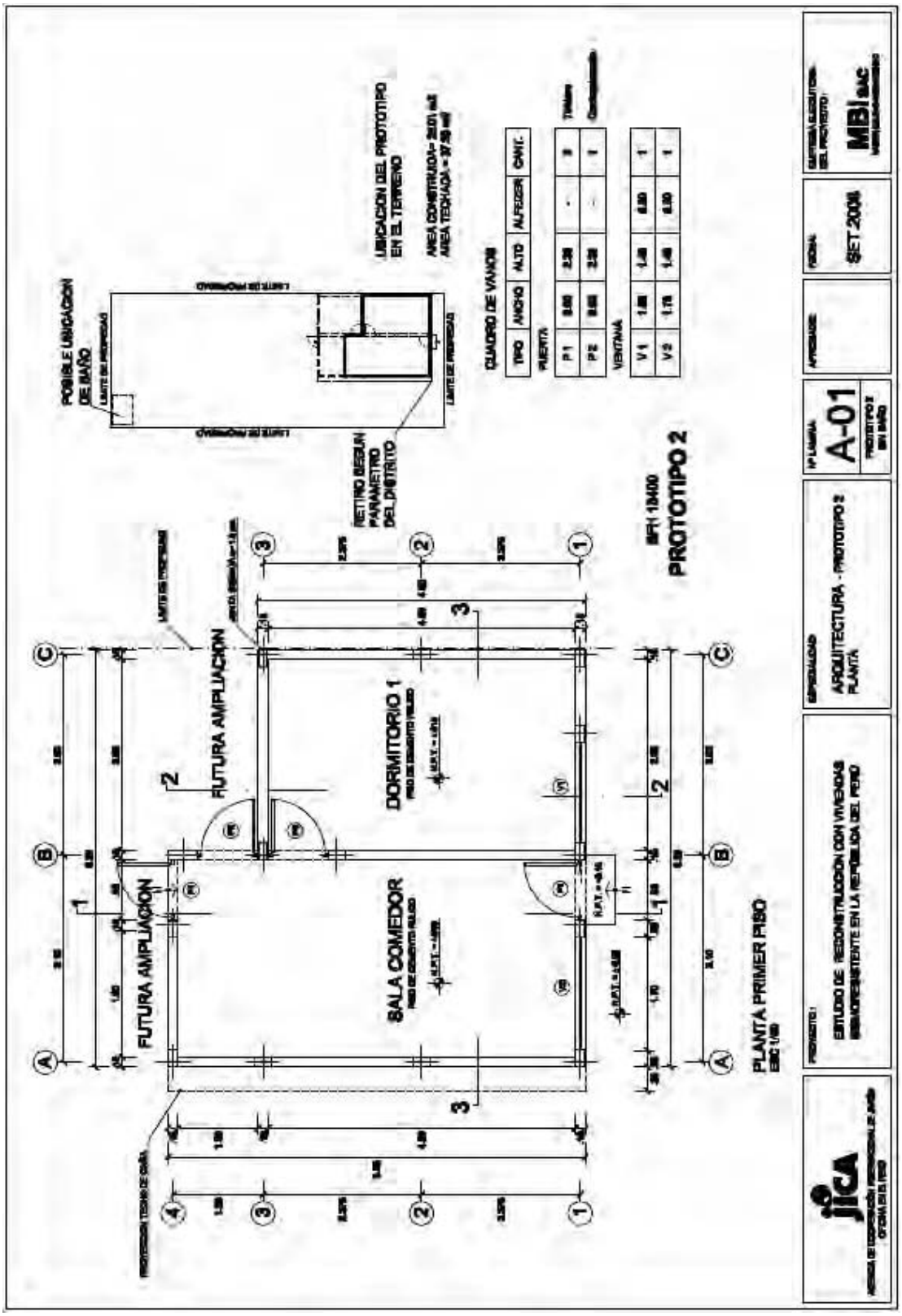
Source) Study for the Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

(2) Prototype 2 (Techo Propio BFH) Toilet inside the house



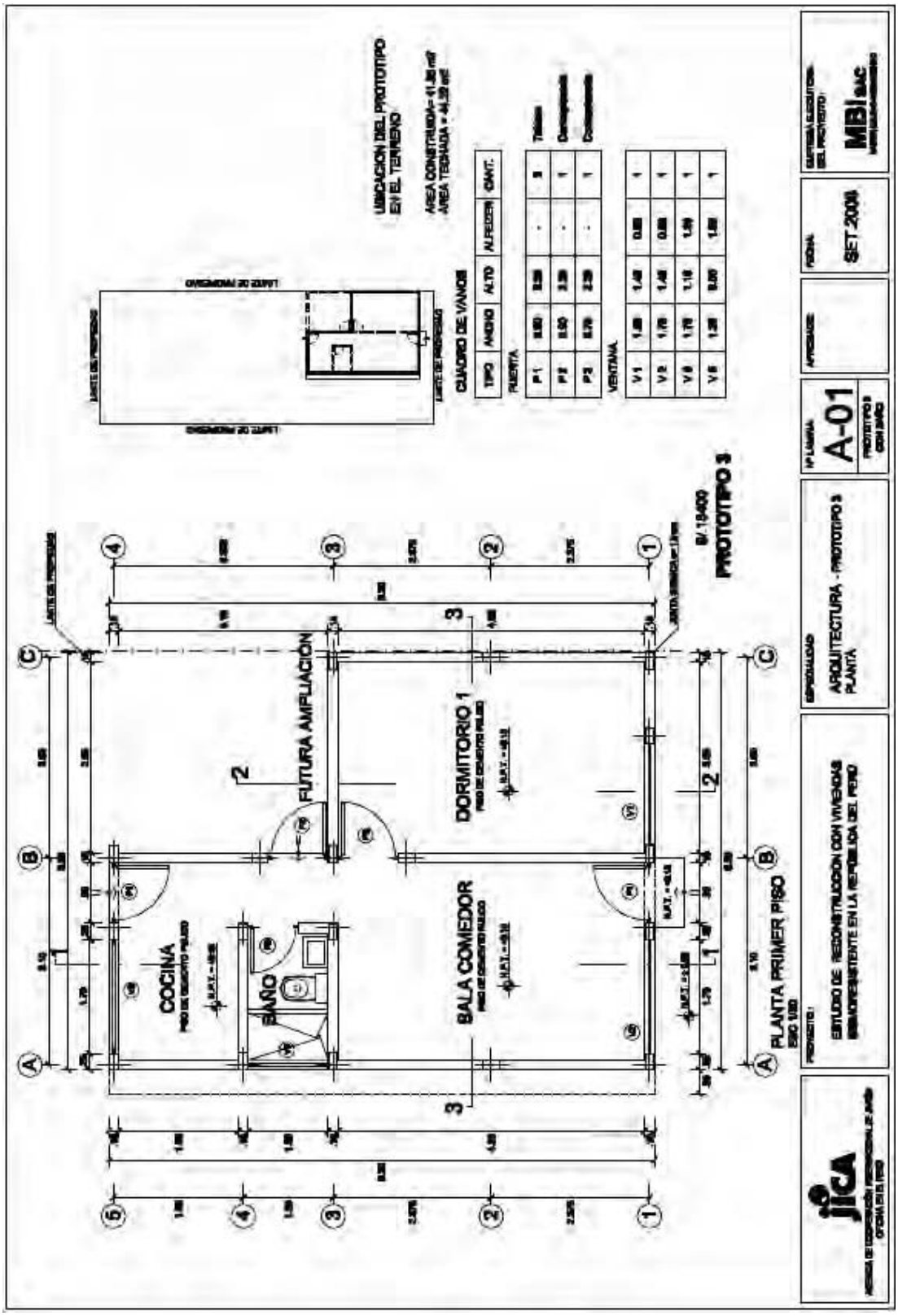
Source) Study for the Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

(3) Prototype 2 (Techo Propio BFH) Toilet outside the house



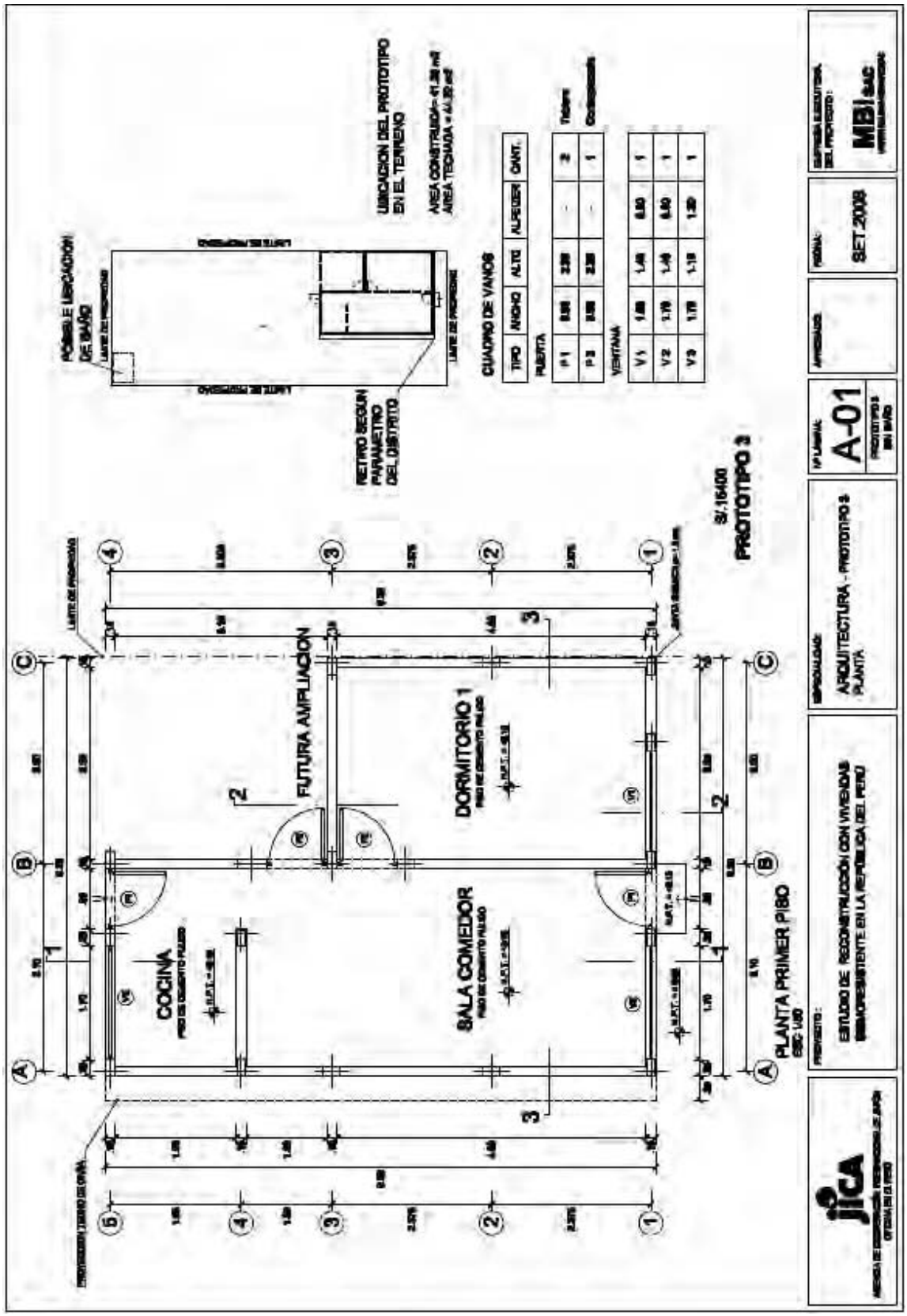
Source) Study for the Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

(4) Prototype 3 (S/. 15,400) Toilet inside the house



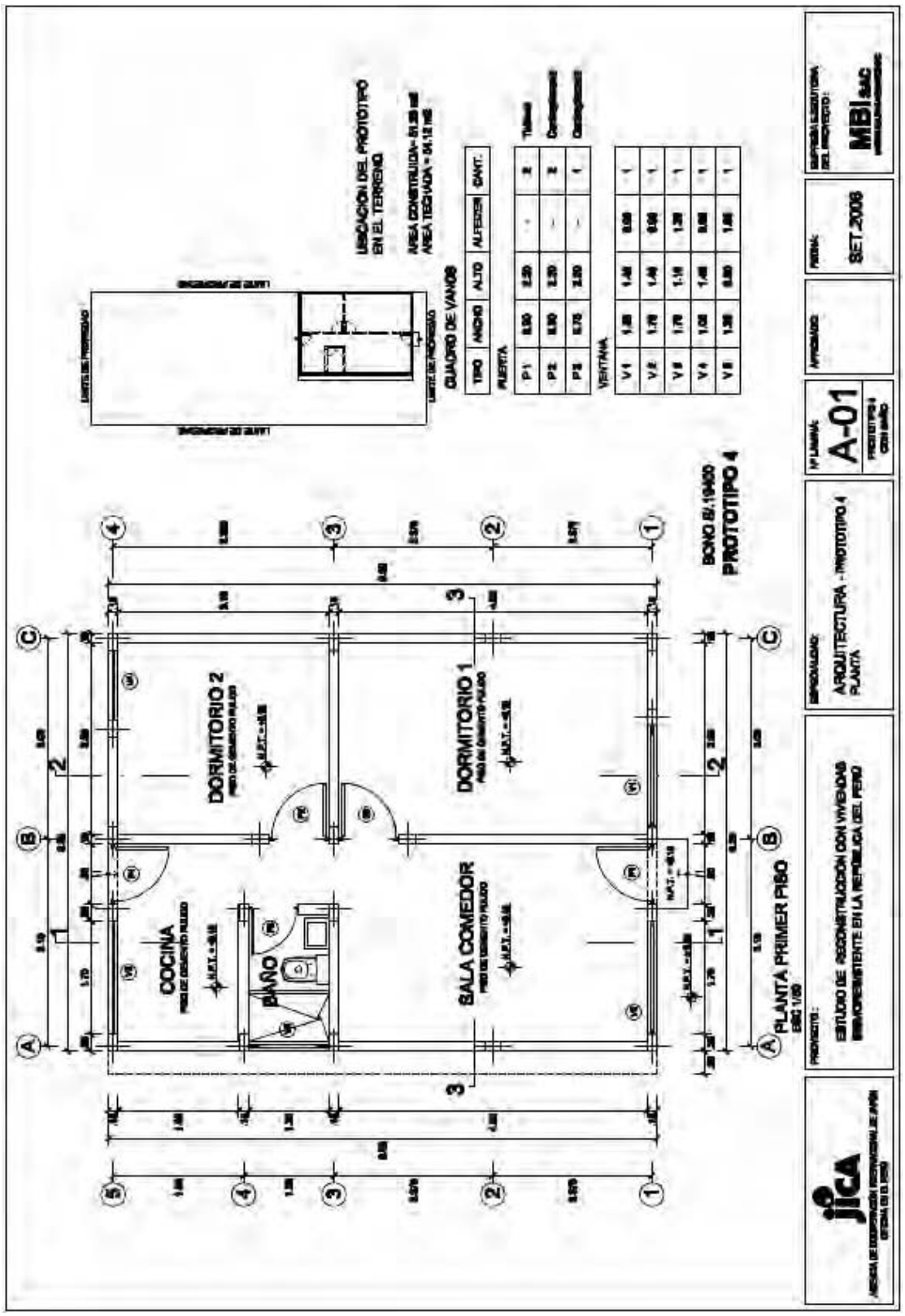
Source) Study for the Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

(5) Prototype 3 (S/. 15,400) Toilet outside the house



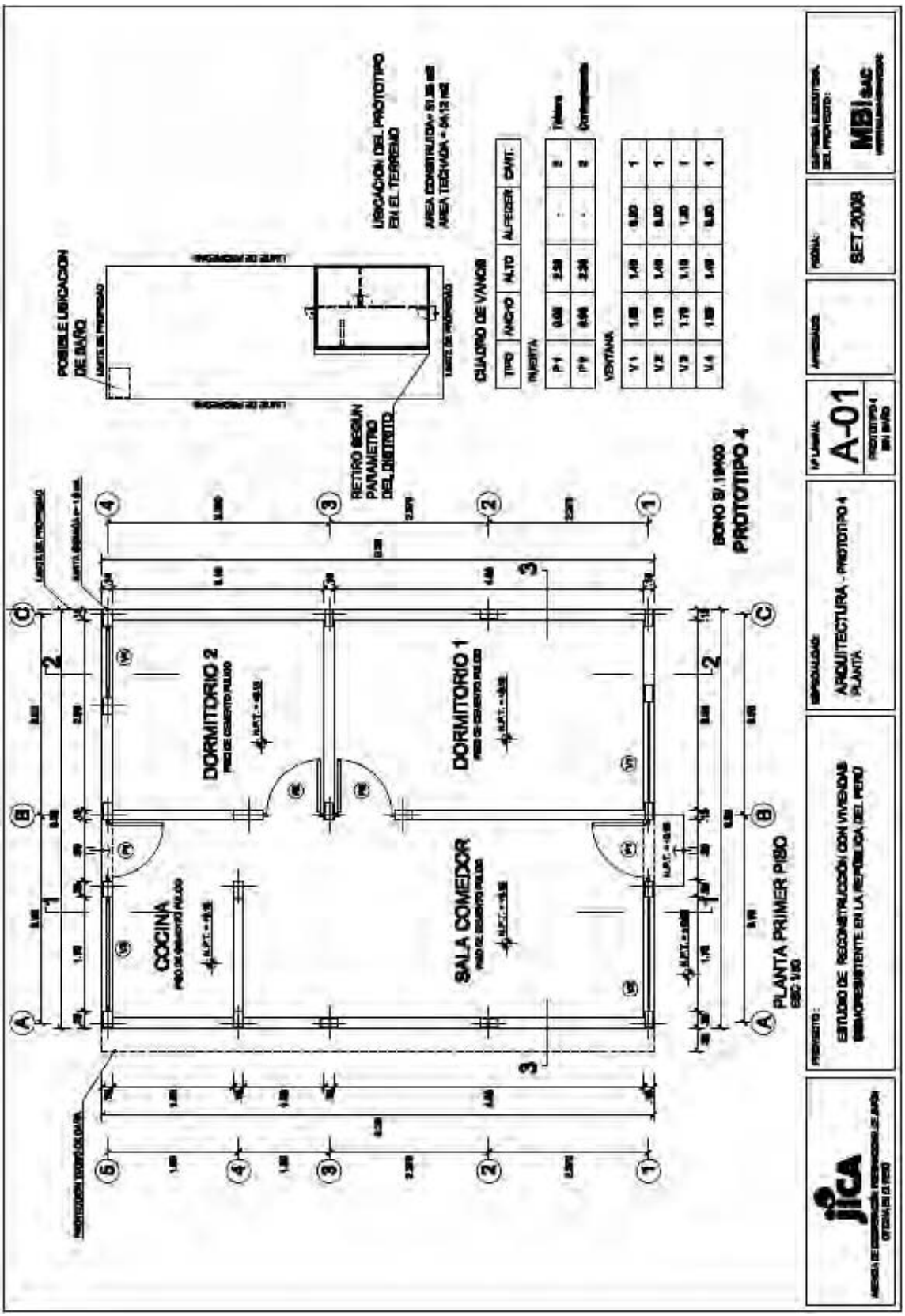
Source) Study for the Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

(6) Prototype 4 (BONO 6000 + Techo Propio BFH) Toilet inside the house



Source) Study for the Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

(7) Prototype 4 (BONO 6000 + Techo Propio BFH) Toilet outside the house



Source) Study for the Reconstruction with Seismic-Resistant Housing in the Republic of Peru, conducted by JICA Study Team

Appendix A5: Table of Contents
Manual of Watching Over Construction of Safer Housing

Table of Contents

Appendix A6: Table of Contents
Manual of Simple Inspection for Safer Housing