



ASSESSING THE ADOPTION, USE, AND  
COMMUNICATION OF THE ECUADOR SHELTER  
CLUSTER'S KEY MESSAGES

## ABOUT THIS REPORT

This report summarizes the findings of a research investigation of the Ecuador Shelter Cluster's Key Messages. This study was supported by the International Federation of Red Cross and Red Crescent Societies (IFRC) and the Global Shelter Cluster and took place from June – August 2017.

The data was collected and analyzed by Casie Venable from the University of Colorado Boulder.

## ACKNOWLEDGEMENTS

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Thanks also to the Mortenson Center in Engineering for Developing Communities at the University of Colorado Boulder.

### **Photo Credit**

A home destroyed in the April 2016 earthquake in Portoviejo, Ecuador. August 2017. Taken by Casie Venable.

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**Building in Portoviejo, Ecuador, damaged in the April 2016 earthquake. Taken by Casie Venable.**

## Introduction

On April 16, 2016, a magnitude 7.8 earthquake struck Ecuador, 27 kilometers south of the coastal city of Muisne. As a result of the earthquake, an estimated 400,000 people were affected and 45,000 houses were either damaged or destroyed. In addition to the significant response from the Ecuadorian government, numerous nongovernmental organizations (NGOs) responded to the earthquake, providing emergency and eventually permanent shelter for those affected.

The Ecuador Shelter Cluster was convened immediately after the earthquake and was active in Ecuador until September 2016. As one of the main objectives of the Ecuador Shelter Cluster was to provide technical support and resources to NGOs with a shelter response, two documents outlining key ideas for safer construction were created. Referred to as the “Key Messages,” these documents, finalized in early September 2016, depict important concepts for “building back safer.”

In this study, we analyzed how the Key Messages were adopted and communicated by NGOs and used and understood by households. The following report discusses the study methodology, important findings, and future recommendations.

## How the study was conducted

This study examined the use of the Ecuador Shelter Cluster’s Key Messages in shelter reconstruction and recovery following the April 2016 earthquake. This study was conducted from June – August 2017, in numerous communities in the Ecuadorian provinces of Esmeraldas and Manabí.

### Data collection

The primary means of collecting data were semi-structured interviews and community surveys. Representatives from NGOs participated in semi-structured interviews that lasted from 30-45 minutes. Most interviews were conducted in English, with a handful being completed in Spanish. These interviews sought to understand the NGO’s response in shelter, including program design, beneficiary selection, levels of community participation, and any training methods. Additional questions focused on the NGO’s participation in the Ecuador Shelter Cluster, awareness of the Key Messages, and means of using the Key Messages in their shelter program. An interview guide can be found in Appendix I.

Surveys were conducted with households affected by the earthquake. Surveys were conducted in Spanish, and responses were recorded using a smartphone and the Open Data Kit application. Cruz Roja Ecuatoriana staff and volunteers assisted in collecting survey responses. Questions sought to understand the impact of the earthquake, shelter assistance received by households, levels of participation in shelter recovery, and knowledge and use of the Key Messages. Particular questions focused on the ways households interacted with the Key Messages, how they used them in reconstruction, and how well they understood the messages. The survey questionnaire can be found in Appendix II.

### Participants

The participants in this study were representatives of NGOs that responded to the earthquake and households that were affected by the earthquake. Some households had received a form of shelter (transitional or permanent) from either the government or an NGO and some households had not. Most participant households were located in the Manabí province.

In total, 26 individuals, representing 17 organizations were interviewed and 110 households were surveyed. The table below provides more details on the households that participated in this study.

**Table 1. Number of households surveyed**

Province	Canton	Received Shelter	Did Not Receive Shelter	Total Surveyed
Esmeraldas	Muisne	1	23	24
Manabí	Jama	3	12	15
	Montecristi	5	0	5
	Pedernales	28	3	31
	Portoviejo	2	0	2
	San Vicente	8	0	8
	Sucre	16	9	25
<b>TOTAL</b>		<b>63</b>	<b>47</b>	<b>110</b>

## Data analysis

A content analysis was conducted on the NGO interviews to identify themes in the use and communication of the Shelter Cluster's Key Messages. Survey responses were aggregated into a single spreadsheet to identify themes across communities, shelter programs, and demographics. The results from this analysis are discussed in the following section.



Shelter reconstructed in San Vicente, Ecuador. Taken by Casie Venable.

## Results

This section contains the results from this study of the Ecuador Shelter Cluster's Key Messages. Results were categorized into four areas of key findings: **Methods of Communicating, NGO Adoption and Use, Community Understanding and Use,** and **Self-Recovery Exposure.** Each of these four areas are discussed in further detail below.

### Methods of communicating

Six methods of sharing and communicating the Key Messages were identified in this study:

- NGO-led training & training materials
- Person-to-person
- Radio
- TV
- NGO-distributed calendars
- Posters in community gathering places

These six methods had varying levels of success and distribution, with repeated exposure through training being the most successful. The methods are discussed below.

#### NGO-led training & training materials

A key factor in participants' message retention was repeated engagement with an NGO that was promoting and discussing the Key Messages. When asked if they had seen the messages or understood the messages, the households that had participated in weekly trainings or had an active role in construction oversight were the ones who most often remembered these messages.

A few organizations had, and still have, weekly training sessions in the communities, and although not all of these sessions revolve around safe construction techniques, repeated exposure to the idea of thinking about safe construction seemed to encourage long-term memory and understanding of these messages. Additionally, those households that were present during the construction phase and were exposed to the messages during construction seemed to also have a better recollection of the key ideas.

Disseminating the messages during prolonged training sessions and shelter construction occurred in a variety of ways. For example, four NGOs had training sessions where the messages were projected and discussed. Additionally, three NGOs created short construction and maintenance manuals that included certain Key Messages.

#### Person-to-person

A common perception among NGOs was that those that were exposed to the Key Messages during training would share what they learned with their family and friends that were unable to attend the training sessions. However, the survey results indicate that this did not occur as expected. More often than not, participants that had not attended a training were unfamiliar with the messages. For example, in many cases where the male head-of-household had attended training (confirmed by the participating NGO), the women or adult children that completed the survey had no prior exposure to the Key Messages, revealing that the messages were not being disseminated via word-of-mouth as anticipated.

## Radio

The Ecuador Shelter Cluster, in partnership with Cruz Roja Ecuatoriana, created a series of radio messages to be broadcast in order to share main ideas from the Key Messages. Seven messages, ranging from 30-45 seconds in length were created and played via radio in the morning and afternoon for two months. The messages were broadcast in four communities.

However, this form of communicating the messages seemed to be largely ineffective. Most households either did not have a radio or did not listen to the radio. Of the 110 households surveyed, only 6 participants had heard the radio messages. Those that did hear the radio messages had a mid-level understanding of what the messages were trying to convey. Reasons for this include:

- The messages lacked visuals
- Listeners could not connect the messages to practical situations
- The messages were too quick
- Listeners were not paying close attention to the messages
- The messages lacked explanations

## TV

In contrast, however, TV seemed to be a more effective way to share the messages. Although the Shelter Cluster did not specifically create messages for TV, the government and other clusters did, and when asked about radio messages, participants tended to discuss the TV messages. Many households found that these TV messages were helpful, easier to understand, and more memorable than purely audio (radio) messages.

## NGO-distributed calendars

One method of distributing the Key Messages to households was through a calendar (displayed on a single poster). A portion of the poster was dedicated to an annual calendar while another portion displayed numerous Key Messages. This method of communicating the Key Messages had mixed results. For example, some households that received a calendar had it displayed in their living space and pointed to it when asked about the Key Messages. Still other households had the calendar displayed but had no recollection of having seen the messages when asked. Those participants that recalled and could point to the messages had often been the household member to attend training, while those that did not recognize the messages had not received the training.

## Posters in community gathering places

A final method of sharing and communicating the Key Messages was through posters in community gathering places, such as a local government office, a church, or a hardware store. One NGO in particular described the community posters as an important part of their program to share the messages. However, this method of message dissemination was not discussed by any of the household participants nor seen in community gathering places. As this study occurred more than a year after the earthquake, it is likely that the posters had been removed at the time of investigation.

## NGO adoption and use

During the course of this study, 17 organizations were interviewed regarding their reconstruction process and use of the Shelter Cluster's Key Messages. Through these conversations, three main ideas developed:

- Organizations not involved with the Shelter Cluster were largely unaware of the messages
- Organizations that used the messages during training did not use them in design
- Organizations were interested in a prioritization of the messages

### Organizations outside of the Shelter Cluster

Organizations contacted for interviews were all those listed on the contact sheet available from the Ecuador Shelter Cluster, and 15 of the 17 organizations were involved in some manner with the Shelter Cluster. However, during the course of the interviews and surveys of this study, 2 other organizations were recommended for interviews. These two organizations were not involved with the Shelter Cluster, were Ecuadorian organizations, and were created specifically to respond to the earthquake. Interviews with these organizations sought to understand how they got started, what their goals were, how they went about providing shelter assistance, and whether they were aware of and using the Key Messages. Like other organizations, these two organizations sought to use their resources and skills to provide much-needed shelter assistance; however, they were not aware of the Key Message documents and were, thus, not using them, indicating a need for wider dissemination and publication of the messages.

### Organizations did not use messages in design

Of the 17 organizations interviewed, 11 used or shared the messages at some point during their construction process. However, these organizations did not indicate that they used the messages during their design process. While they recognized that households could benefit from the messages, they themselves did not modify their designs based on the recommendations of the messages. The main reason for this was prior experience in shelter design or partnering with an organization with experience in shelter design.

### Prioritizing the messages

An additional request expressed by organizations was for a prioritization of the Key Messages. This suggestion came particularly from organizations new to providing shelter assistance. They expressed that the presentation of the messages did not indicate whether one message was more important than another. Having priorities in the ideas expressed in the messages might provide those organizations new to shelter assistance, particularly those with limited funding, with more direction for their shelter programs.

## Community understanding and use

When presented with the Key Messages and asked if they had previously seen them, 45 out of the 110 households surveyed responded “Yes.” Those households were then asked a series of questions about when and where they saw the messages, how well they understood them, and how they used them in reconstructing their shelter. The following ideas emerged from the responses:

- Six messages were too many to remember
- Prior construction experience was important for understanding the messages
- Households often lacked the ability to implement the messages in construction

### Too many messages

One of the themes that emerged from the follow-up questions about message understanding was that there were too many messages for community members to remember. Respondents indicated that they remembered “two or three” of the messages, but did not remember all of the messages, and particularly all of the details within the messages. The messages that respondents indicated remembering most often were those relating to location and shape as they had fewer construction details.

### Prior construction experience

Many of the respondents who indicated that they understood the messages very well and knew how to use them during construction were those with prior construction experience. Responses such as, “Yes I understood the messages because I have done construction previously” were common with male respondents, indicating that for these households the messages were not as important in promoting safe construction as prior experiences and knowledge.

### Lack of ability to implement

An additional response that was repeated by respondents was their desire to use the messages to create a safer and stronger home for their family. However, these households often lacked the ability to implement the messages during construction. A majority of households surveyed that had heard or seen the messages received a direct-build shelter from an organization. Organizations were largely responsible for constructing the new shelters and households did not have high levels of participation during construction. Households that expressed an interest in modifying or adding an addition to their shelter also expressed that they lacked the financial means and time to make these additions, thus, limiting their ability to use the messages.

## Self-recovery exposure

Lastly, this study also sought to analyze the impact of the Key Messages on those households that were self-recovering and did not receive shelter assistance from the government or an NGO. 47 of the 110 households surveyed during the study had not received shelter assistance from the government or an NGO. In speaking with those households, two themes emerged:

- Households that were self-recovering did not see the messages
- Households that did not receive assistance were struggling to recover

### Self-recovering households did not see messages

In the communities that did not receive shelter assistance, there was an overwhelming lack of recognition of the messages. Households indicated that they had neither seen or heard the messages through any of the distribution methods described above. While some communities and households had received assistance and training related to health, WASH, or safety, and were able to describe these trainings, they did not indicate that they had received construction training during any NGO-led sessions. Thus, NGOs were instrumental in the spread of the messages.

### Households struggled to recover by themselves

Another observation was that many households that had not received shelter assistance were struggling to repair or rebuild their homes, even over a year after the earthquake. Many families were still living in damaged homes and using tarps to cover openings in windows or roofs. These households also had a difficult time discussing what repairs they had been able to make since the earthquake. The surveyed households were overwhelming from rural communities, and it is likely that those in more urban centers might have been able to rely on more assistance from their neighbors.

## Conclusions

This study sought to understand how the Ecuador Shelter Cluster's Key Messages were adopted, used, and communicated in the response and recovery to the April 2016 earthquake. To achieve these goals, organizations were interviewed and community members were surveyed. While the messages, safer construction, and training were recognized as important by many organizations, this study revealed that the Key Messages were not disseminated as widely as anticipated and many households struggled to implement the ideas expressed in the messages.

Initial limitations on the ability of organizations to provide temporary shelter and a delay in gaining government approval of the Key Messages likely contributed to the smaller organization responses and not-widespread dissemination of the messages.

Nevertheless, repeated exposure to the messages and continued engagement with organizations were revealed as successful methods for communicating the messages and encouraging household understanding. The use of a specific technology – TV – also revealed itself as a communication method with significant promise for future responses.

## Limitations

The discussion of results presented in this report are representative of the households surveyed and households supported by the interviewed NGOs. However, with over 45,000 homes damaged or destroyed by the earthquake, many perspectives were not included. Thus, a larger sample size could reveal additional or contradictory trends, particularly as it relates to households that are self-recovering. Furthermore, as the study took place over a year after the April 2016 earthquake, data could be influenced by the temporal distance from the original event. Lastly, as surveys were conducted during the day when many male heads-of-household were absent from the home, data collected largely reflects the perspective of women and adult children who were likely not as involved in shelter reconstruction.

## Appendix I – NGO Interview Guide

- What organization do you work with?
  - How long have you worked with them?
  - What is your role in this organization?
- What is/was your role during shelter reconstruction?
  
- What communities did your organization/your work in during reconstruction?
- How many shelters were built/are you building in these communities?
- How were homeowners selected?
  
- What were/are your organization's goals for reconstruction?
- How were these goals decided?
- Can you describe the overall reconstruction process?
  
- Were you aware of the Shelter Cluster's Key Messages? To what extent were they incorporated into the reconstruction process?
  - How were they implemented in design? Training? Who received the messages?
  - Why did you decide/not decide to use them?
- Do you have ideas about how the Key Messages should be changed/improved?
  
- Can you describe the decision-making process during the planning and design phases?
- Can you describe the important design features?
- Can you describe the construction process? Who is involved? How is quality assured?
- Did your organization provide training to the communities? Can you describe this training?
  
- How were community input and preferences were solicited and incorporated into the reconstruction process?
- Can you describe how communities/homeowners participated throughout the reconstruction process?
- How and when did you communicate with communities? What information did you gather and what did you provide?

## Appendix II – Community Survey Questionnaire

1. What is the location?  
*Insert community, canton*
2. Which best describes the location?
  - a. Rural
  - b. Urban
3. What is the respondent’s gender?
  - a. Male
  - b. Female
4. What is the name of the head of household?  
*Insert name*
5. How old is the head of household?  
*Input age*
6. Is the head of household male or female?
  - a. Male
  - b. Female
7. What is the marital status of head of household?
  - a. Married
  - b. Single
  - c. Divorced
  - d. Widowed
  - e. Free union

8. What are the ages and gender of household members?

	0-2	3-5	6-17	18-35	35-59	60+
Male						
Female						

9. How long have you lived in this community?  
*Input years*
10. What does the head of household do to make money and how much do they earn a month?  
*Input job*  
*Insert monthly income*

11. How many members of the family work and what is the monthly income?

*Input number of members that work*

*Input monthly income*

12. What is level of education of the head of household?

- a. No education
- b. Elementary school
- c. High school
- d. University

13. What level of damage did your home sustain during the earthquake?

### Categoría de Daño 1-4



No hay daño



Daños menores,  
requiere poca  
asistencia.



Menos del 30% de daño, puede  
ser reparable.



Más del 30% de daño, puede ser  
reparable.



Destruído o dañado no puede  
ser reparado.

- a. Level 0
- b. Level 1
- c. Level 2
- d. Level 3
- e. Level 4

14. Were you displaced?

- a. Yes
- b. No

If the answer is No, go to Question 17.

15. Where did you stay while you were displaced? Check all that apply

- a. With family or friends
- b. In an informal camp
- c. In a government housing center
- d. Rented a property
- e. Other *Input other*

16. How long were you displaced (in months)?

*Input months*

17. Has an organization or the government been working with you during the reconstruction?

- a. Yes
- b. No

If the answer is no, go to Question 22

18. What is the name of the organization or government agency that you have been working with?

*Input organization/agency name*

19. What type(s) of aid have you received? Check all that apply

- a. Housing construction/repair
- b. Cash Voucher
- c. Construction Materials
- d. Technical Training
- e. Shelter Repair Kit
- f. Shelter Kit
- g. Tool Kit
- h. Kitchen Kit
- i. Hygiene Kit
- j. Tarpaulins/Tent
- k. Other *Input other*

20. How often or not do you communicate with this organization/government agency?

- a. Less than once a month
- b. Once a month
- c. 2-3 times a month
- d. Once a week
- e. More than once a week

21. How do you communicate with this organization/government agency? Check all that apply
- a. In person
  - b. Via phone
  - c. Via email
  - d. Via written correspondence
  - e. Community meeting
  - f. Other
22. Were you relocated to a new community or area?
- a. Yes
  - b. No
23. How have you participated in the rebuilding your home? Mark all that apply.
- a. Selecting the location
  - b. Selecting the size or shape
  - c. Selecting the materials
  - d. Buying the materials
  - e. Hiring a mason or other professional
  - f. Building your home
  - g. Overseeing the construction of your home
  - h. Other *Input other*

SHOW KEY MESSAGES HERE

24. Have you seen these messages before?
- a. Yes
  - b. No
- If the answer is no, go to Question 33
25. Where have you seen these messages? Mark all that apply
- a. Someone showed them to me
  - b. In a local hardware store
  - c. In a local government office
  - d. TV
  - e. Radio
  - f. Other *Input other*
26. Who showed you these messages? Mark all that apply
- a. A representative from an organization *Input organization*
  - b. A family member
  - c. A friend
  - d. A construction professional
  - e. Other *Input other*

27. How were you shown or taught these messages? Mark all that apply
- In a construction training
  - In a community or organization meeting
  - By observing the construction of other homes
  - Other *Input other*
28. On a scale from 1-5, how well or not well did you understand these messages?
- I did not understand them at all
  - I did not understand them well
  - I understood some of the messages but not all
  - I understood most of the messages
  - I completely understood the messages
29. Why did you or didn't you understand these messages? What about them made them easy or difficult to understand?
- Input explanation*
30. On a scale from 1-5, how useful or not useful were these messages in the rebuilding process?
- The messages were not useful at all
  - The messages were not very useful
  - Some of the messages were useful
  - Most of the messages were useful
  - The messages were extremely useful
31. On a scale from 1-5, how often or not did you or someone in your household use these messages during construction?
- We never used these messages
  - We rarely used these messages
  - We used these messages sometimes
  - We used these messages in most decisions we made about our house
  - We used these messages in every decision we made about our house
32. Did having these messages change any of your decisions during construction? How so?
- Input yes/ no and explanation*
33. Have you been given other information to help in the reconstruction of your house? Can you describe that information?
- Input yes/ no and explanation*
34. Have you received any training about how to build or maintain your home? Can you describe that training?
- Input yes/ no and explanation*

35. Do you plan to modify or add to your home? Can you describe what you plan to do?  
*Input yes/no and explanation*

36. Have you heard any messages about reconstruction on the radio?

a. Yes

b. No

If the answer is no, go to Question 43

37. How often did you hear these messages on the radio?

a. Every day

b. More than once a week

c. Once a week

d. More than once a month

e. Less than once a month

38. How many different messages did you hear about reconstruction on the radio?

a. One

b. Two-Three

c. Four-Five

d. Six-Seven

39. On a scale from 1-5, how well or not well did you understand the messages on the radio?

1. I did not understand them at all

2. I did not understand them well

3. I understood some of the messages but not all

4. I understood most of the messages

5. I completely understood the messages

40. Why did you or didn't you understand these messages? What about them made them easy or difficult to understand?

*Input explanation*

41. On a scale from 1-5, how useful or not useful were the radio messages?

1. The messages were not useful at all

2. The messages were not very useful

3. Some of the messages were useful

4. Most of the messages were useful

5. The messages were extremely useful

42. Did hearing these radio messages change any of your decisions during construction? How so?

*Input yes/no and explanation*

43. After the earthquake, how quickly did you and the members of your household return to work or school?

*Input number of months*

44. How long did it take before you inhabited your new/repared home?

*Input number of months*

45. Now that you know what we're interested in learning, is there anything else I should have asked you or that you would like to share?

*Input response*



## APOYO PROFESIONAL



1. Una vivienda se puede construir de diferentes maneras: hormigón armado y mampostería (bloques o ladrillos), adobe, madera, caña guadua, quincha o sistemas mixtos. Lo más importante de toda construcción son los materiales y las técnicas de construcción. ¡Una vivienda mal construida con cualquier material que se utilice es peligrosa! Busca ayuda profesional.

2. Estos mensajes resultan de observaciones sobre prácticas constructivas en la zona afectada. Ayudan a aclarar principios básicos pero no sustituyen el acompañamiento profesional.

3. Una vivienda dañada debe obtener permisos del municipio antes de empezar a reparar o reconstruir, averigua los procedimientos a seguir en tu municipio y respeta la norma de construcción.

4. En caso de duda, busca asistencia de un profesional o de las autoridades locales.

5. Estos mensajes son principios generales para viviendas de 1 a 2 pisos. Buscar apoyo de profesionales de la construcción es muy importante. No juegues con tu vida, ni la de los tuyos. Cuida tu inversión. ¡ASESÓRATE!

## CONSTRUIR UNA CASA SEGURA

1

**LA SEGURIDAD DE LA CASA DEPENDE DE SU UBICACIÓN Y FORMA**

2

**ENTENDER Y ESCOGER LOS PRINCIPIOS CONSTRUCTIVOS**

3A

**CALIDAD DE MATERIALES DE CONSTRUCCIÓN LIVIANOS : GUADÚA**

3B

**CALIDAD DE MATERIALES DE CONSTRUCCIÓN LIVIANOS : MADERA**

3C

**CALIDAD DE MATERIALES DE CONSTRUCCIÓN PESADOS**

4

**CONSTRUIR UNA CIMENTACIÓN SÓLIDA**

5

**PAREDES Y CERRAMIENTOS SÓLIDOS**

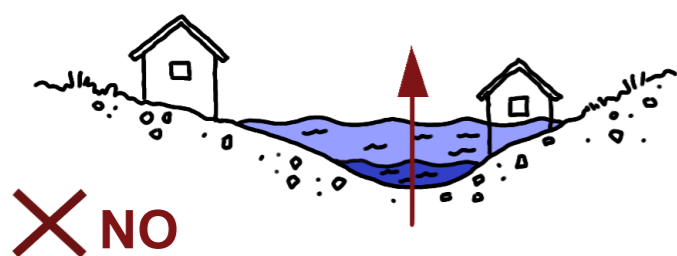
6

**MANTENIMIENTO Y CONFORT DE LA CASA**



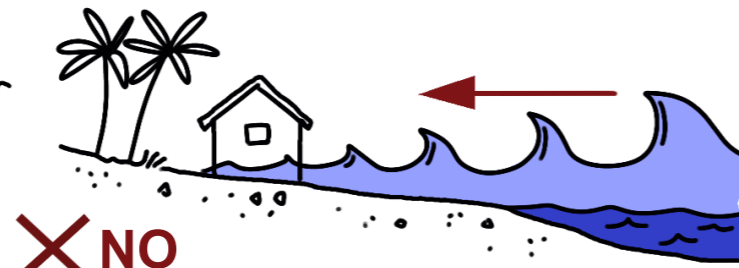
1 LA SEGURIDAD DE LA CASA DEPENDE DE SU UBICACIÓN Y FORMA

1A : UBICACIÓN DE LA CASA



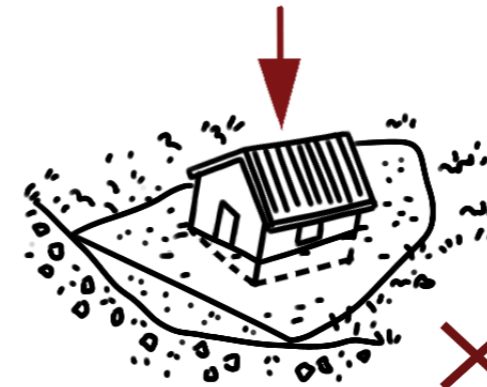
X NO

No construir cerca de ríos o de una zonas inundables.



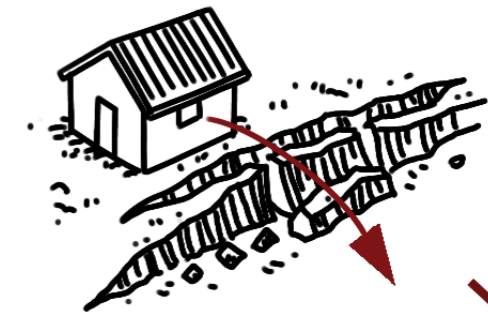
X NO

Es peligroso construir cerca de la costa (riesgo de tsunamis).



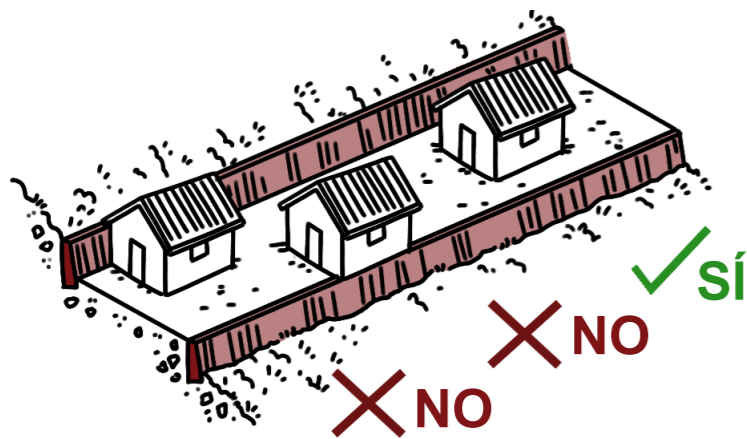
X NO

No construir sobre relleno sanitario o tierra agrícola.



X NO

No construir cerca de acantilados.

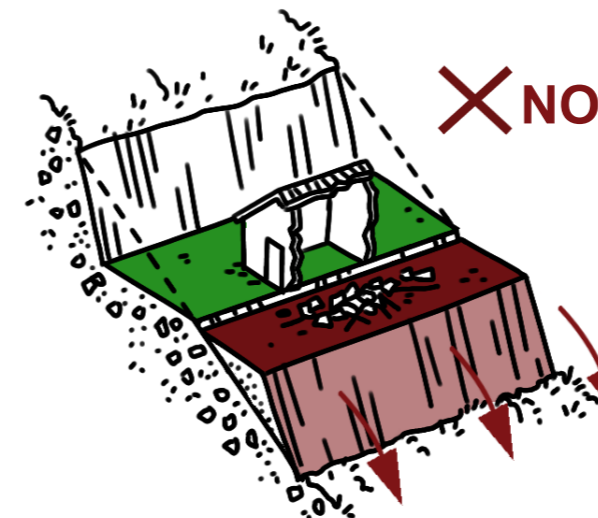


Construir separado del muro,os (no adosado y no apoyado).



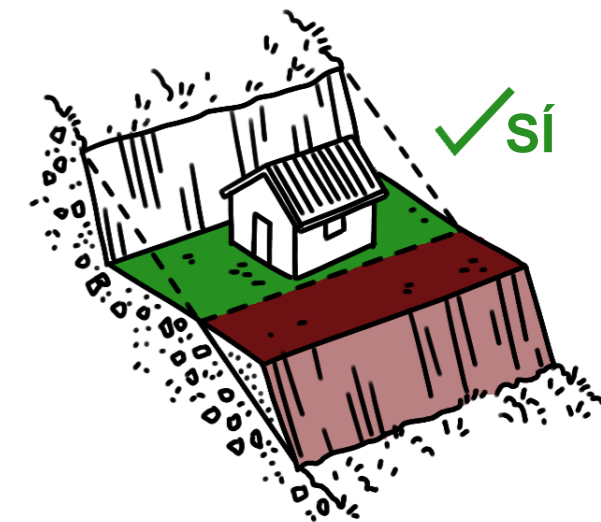
X NO

No construir en barrancos ni zonas de derrumbe.



X NO

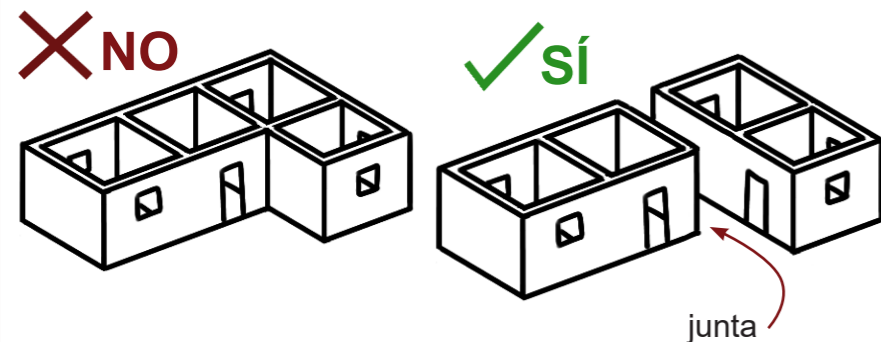
No contruir sobre rellenos.



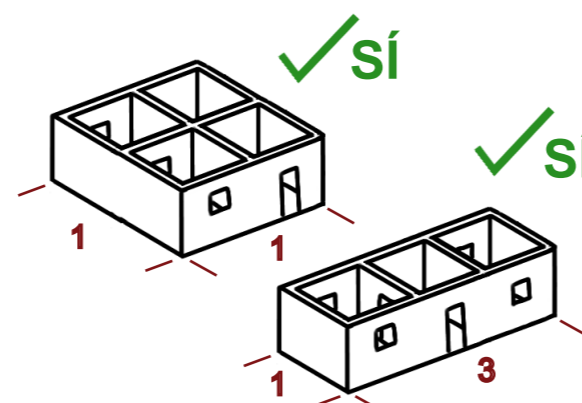
✓ SI

Mantega buena distancia al borde del relleno.

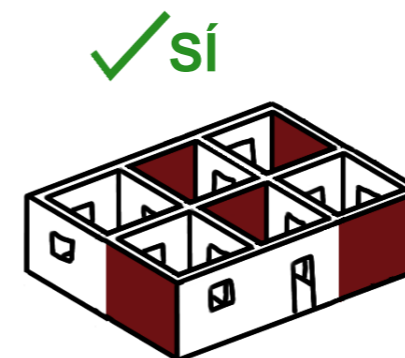
1B : FORMA DE LA CASA



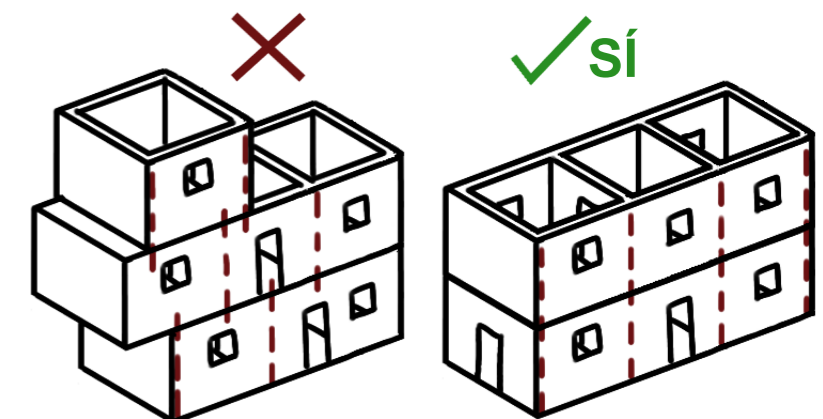
Evitar las formas complicadas, creando juntas sísmicas. Mínimo 10 cm (recomendado 45-60 cm).



Mejor proporción: 1:1  
Buena propoción: 1:2  
Proporción máxima: 1:3



Cada fachada debe tener al menos una pared llena.



Las paredes deben ser colocadas continuamente, una encima de la otra. ¡del suelo hasta el techo!



2A : CONSTRUCCIÓN HOMOGÉNEA



Cobertura y piso livianos (tipo madera o bambú).

LAS CONSTRUCCIONES LIVIANAS SON MÁS FLEXIBLES Y PUEDEN DEFORMARSE MÁS QUE LAS PESADAS.

Consulte a un profesional para dimensionar los elementos y asegurar un arrostramiento eficaz.



Cobertura liviana y 2 pisos pesados (tipo albañilería).

CONSTRUCCIONES PESADAS NO TOLERAN DEFORMACIONES: DEBEN SER DURAS.

Consulte un profesional para construir una mampostería sismo resistente (reforzada o confinada).

2B : CONSTRUCCIÓN MIXTA



Cobertura liviana y segundo piso liviano sobre primero piso pesado.

MENOS PESO EN ALTURA LIMITA LA AMPLIFICACIÓN DE LAS FUERZAS DEL SÍSMO.

Es mejor concentrar el peso cerca del suelo. Consulte un profesional para dimensionar los pilares.

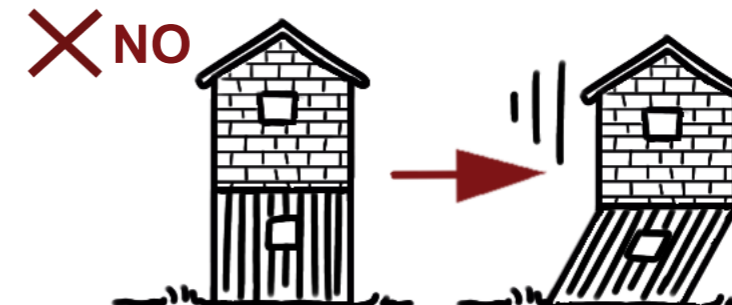
2C : CONSTRUCCIÓN DE RIESGO



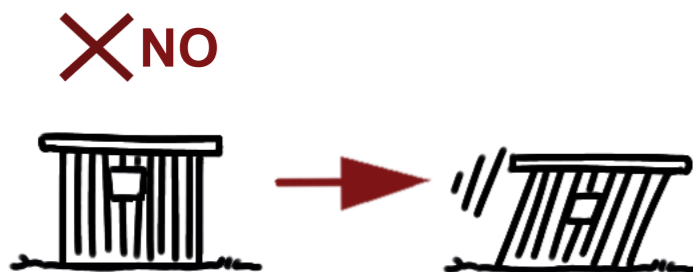
Casa pesada sobre pilares livianos o sobre pilares de hormigón subestándar (piso blando). ¡Hay riesgo de ruptura de los pilares!

¡MÁS PESO EN ALTURA SOLICITA MÁS LA ESTRUCTURA ABAJO!

Es mejor concentrar el peso cerca del suelo. Consulte un profesional para dimensionar los pilares.



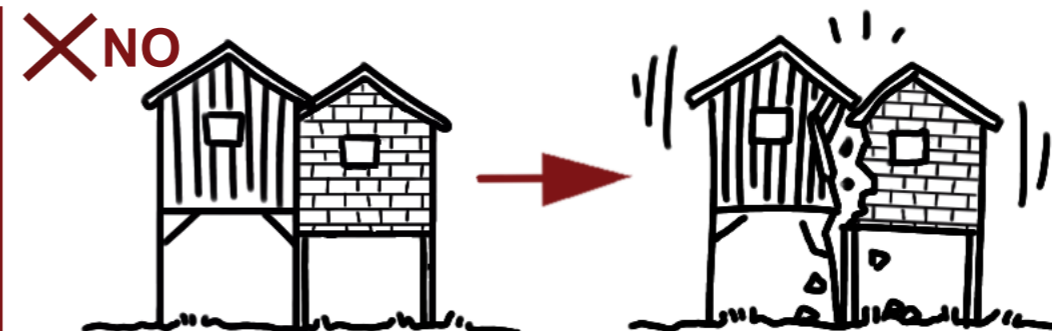
Segundo piso pesado sobre primer piso liviano (piso blando). ¡Hay riesgo de caída del piso blando y de la casa!



Losa de hormigón sobre paredes livianas o sobre paredes de mampostería subestándar o sobre columnas (piso blando). ¡Hay riesgo de caída del piso blando y de la casa!

MÁS PESO EN ALTURA REQUIERE MÁS ESTRUCTURA ABAJO

Si se necesita una losa consulte un profesional.

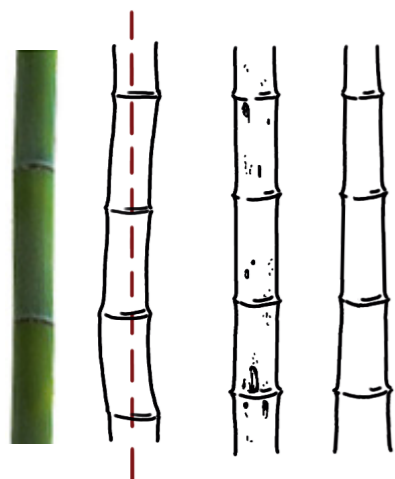


Dos casas o partes de casas construidas por técnicas diferentes se comportan diferente con el sismo y pueden causar daños al colisionar.

SIEMPRE DEJA UNA SEPARACIÓN ENTRE 2 CASAS O ENTRE PARTES DE CASAS CONSTRUIDAS POR TÉCNICAS DIFERENTES.

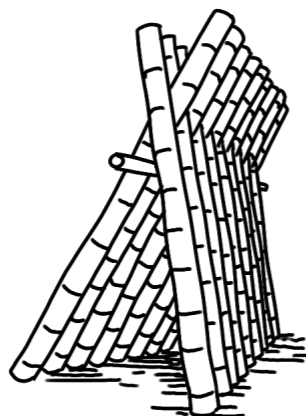


3A : CAÑA GUADÚA



**NO**

No usar caña verde, retorcida o con huecos. No se debe seleccionar cañas cuyos diámetros sean muy diferentes en los extremos.

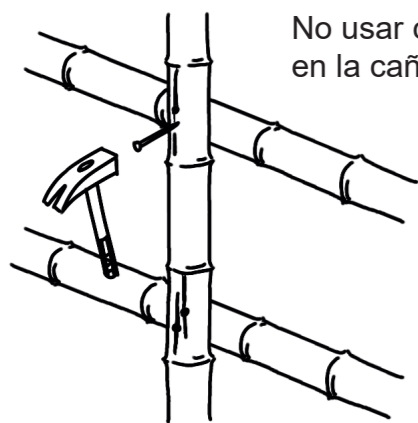


**SÍ**

Usar una buena materia prima:  
- madura o hecha  
- preservada  
- seca  
- recta  
- sin rajaduras

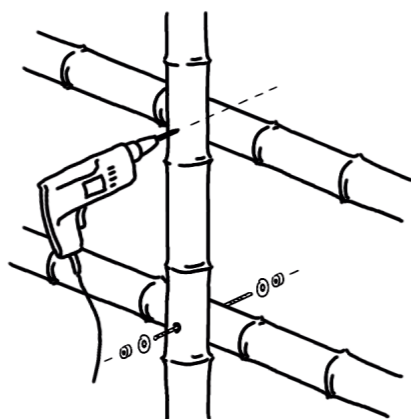
**NO**

No usar clavos en la caña roliza.



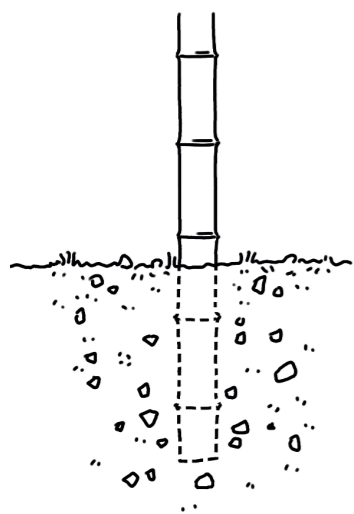
**SÍ**

Empernar:  
- hacer perforaciones con taladro  
- usar pernos, tarugos, arandelas, varilla enroscada  
- tapar orificios



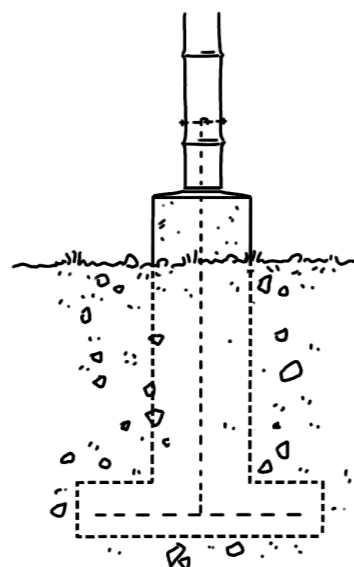
**NO**

No enterrar la caña en el suelo.

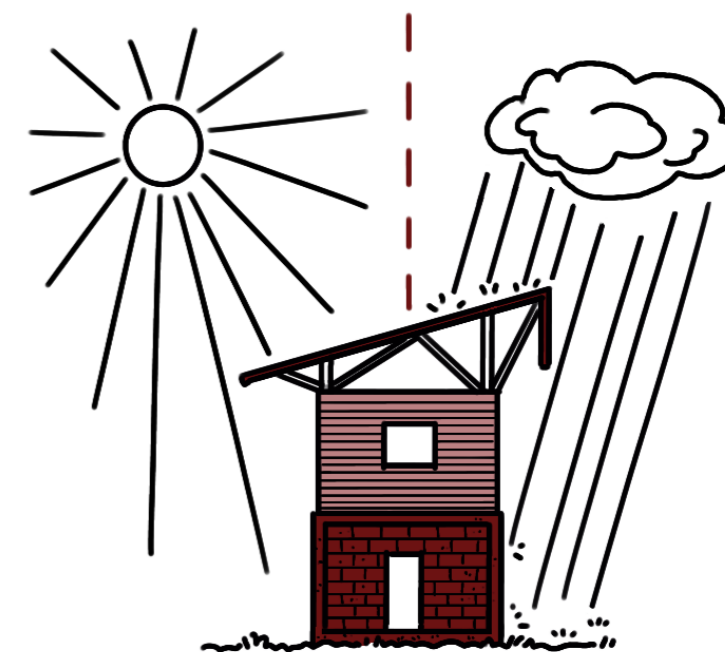
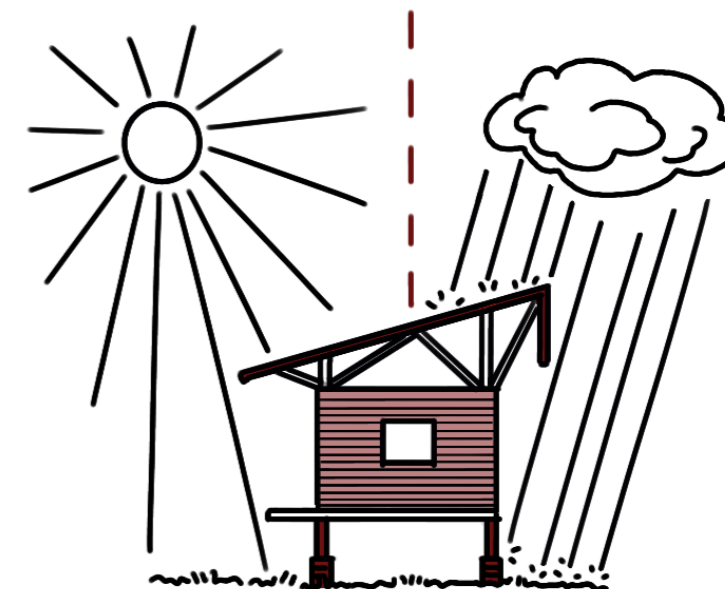


**SÍ**

Elevar la caña sobre un cemento:  
- resistente para soportar el peso de la casa  
- aislar de la humedad



La caña debe estar protegida de la lluvia, del sol fuerte y de la humedad del suelo. Por eso la casa debe tener: un buen sombrero, una buena capa y buenas botas.



**SÍ**

1. un buen sombrero:  
techos amplios.

**SÍ**

2. una buena capa:  
paneles de caña picada, fáciles de sujetar y posibles de revestir si están expuestos.

**SÍ**

3. buenas botas:  
cimentos para aislar de la humedad.

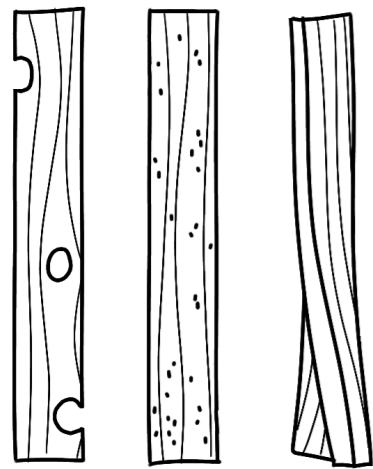


3 CALIDAD DE MATERIALES DE CONSTRUCCIÓN

3B : MADERA

Asegurarse que la madera sea legal y controlada:

- si es de origen no controlada o ilegal o de fuentes no renovables, este fomenta la deforestación.
- es una buena señal si el vendedor puede mostrar una certificación de la madera.

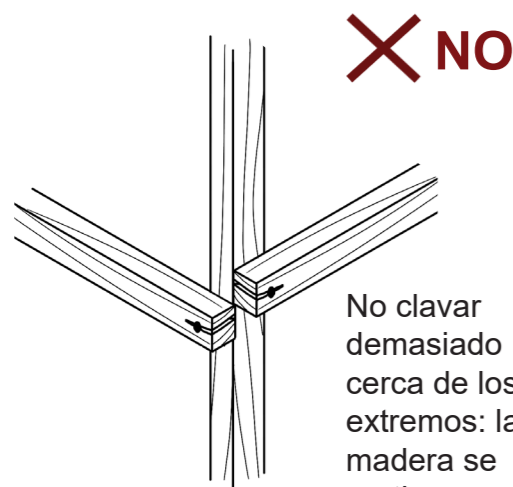


**X NO**

No usar madera verde (no seca), con huecos, con bichos o retorcida.

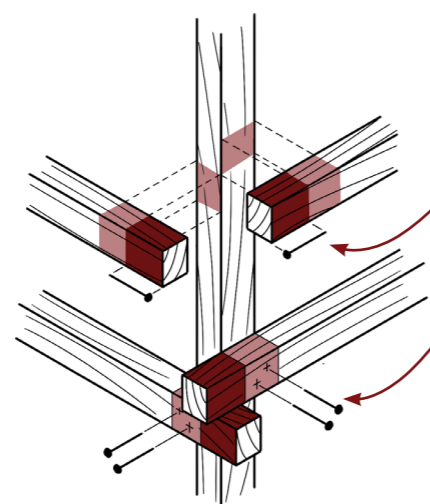


**✓ SÍ**



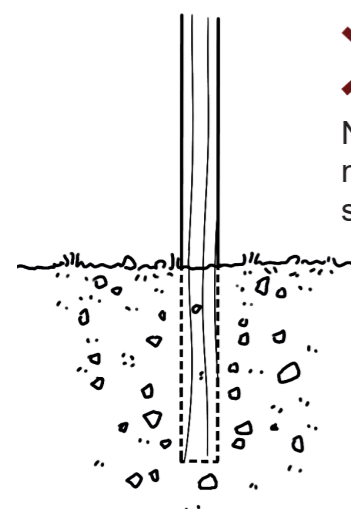
**X NO**

No clavar demasiado cerca de los extremos: la madera se partira.



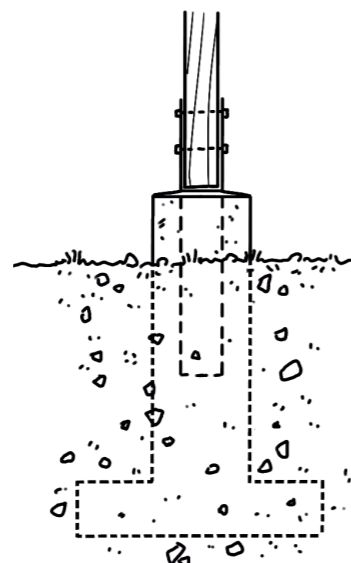
**✓ SÍ**

- Zonas a clavar:**
- dejar la longitud de un clavo desde la extremidad.
  - colocar 2 clavos en cada tercio del ancho de la pieza de trabajo.



**X NO**

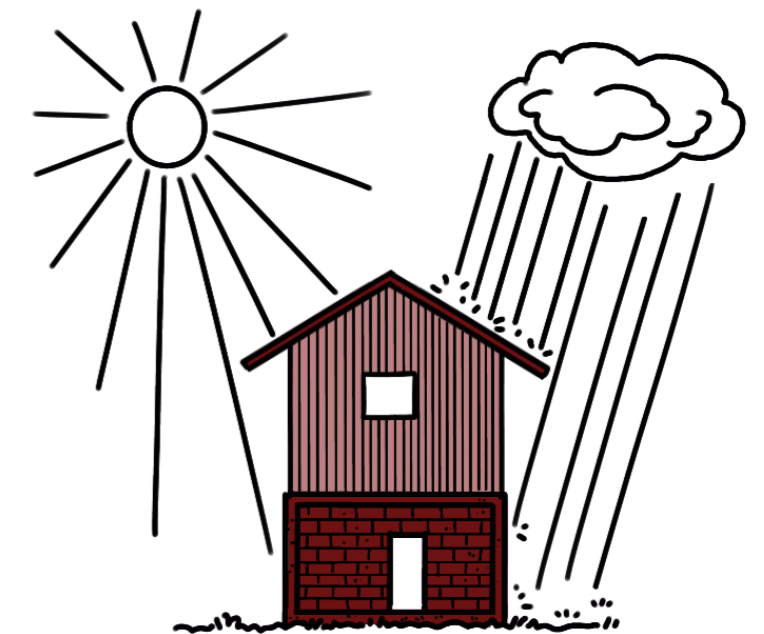
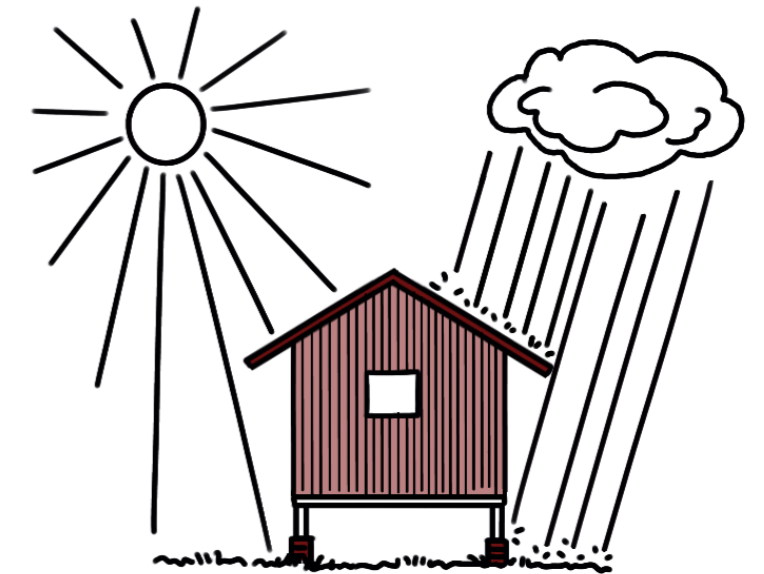
No enterrar la madera en el suelo.



**✓ SÍ**

- Elevar la madera sobre un cemento:**
- resistente para soportar el peso de la casa
  - aislar de la humedad

La madera debe estar protegida de la lluvia, del sol fuerte y de la humedad del suelo. Por eso la casa debe tener: un buen sombrero, una buena capa y buenas botas.



**✓ SÍ**

- 1. un buen sombrero:**  
techos amplios.

**✓ SÍ**

- 2. una buena capa:**  
paneles de madera, fáciles de sujetar y posibles de revestir si están expuestos.

**✓ SÍ**

- 3. buenas botas:**  
cimentos para aislar de la humedad.



3C : MATERIALES PESADOS



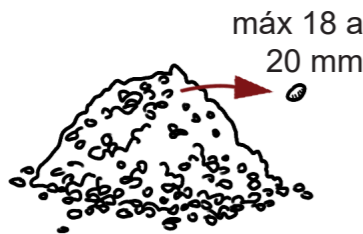
**Agua:**  
limpia y sin sal.



**Cemento:**  
Portland, sacos nuevos y secos.



**Arena:**  
de río, ¡no de playa!  
lavada y seca.



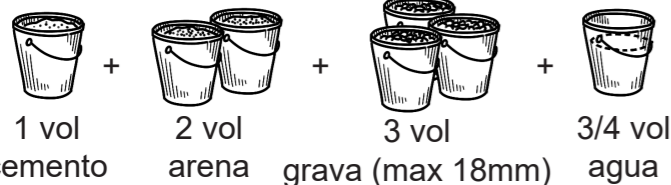
**Gravas:**  
triturada o rodada,  
de roca dura y limpia.

**Barras de acero:**  
tamaños estandares,  
corrugadas, grado 60,  
nuevas y sin corrosión.

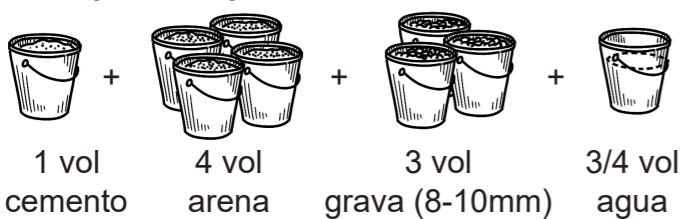


No usar barras de segunda mano o ya dobladas.

**Mezcla para hormigón:**



**Mezcla para bloques de cemento:**



**Mezcla para mortero:**



**Ladrillos:**

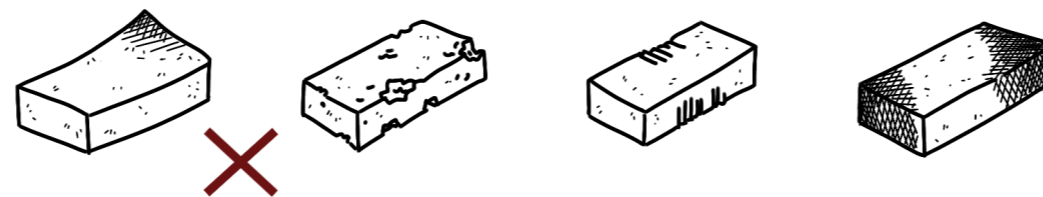
ancho recomendado 12,5 - 15 cm

✓ sí

Huecos verticales deben ser menos de 50% de la superficie horizontal.

¡No ladrillos en posición vertical!

Los ladrillos, macizos o perforados, deben estar en buen estado: forma regular sin defectos sin quiebre color uniforme



**Pruebas sencillas para ladrillos buenos:**

**“Prueba de los 3 puntos”:**  
Una persona sube encima de un ladrillo colocado sobre otros dos.  
¡El ladrillo debe resistir!

Al chocarlos uno contra otro, los ladrillos deben producir un sonido metálico.

**Bloques de cemento:**

grosor interno 2,5 cm

✓ sí

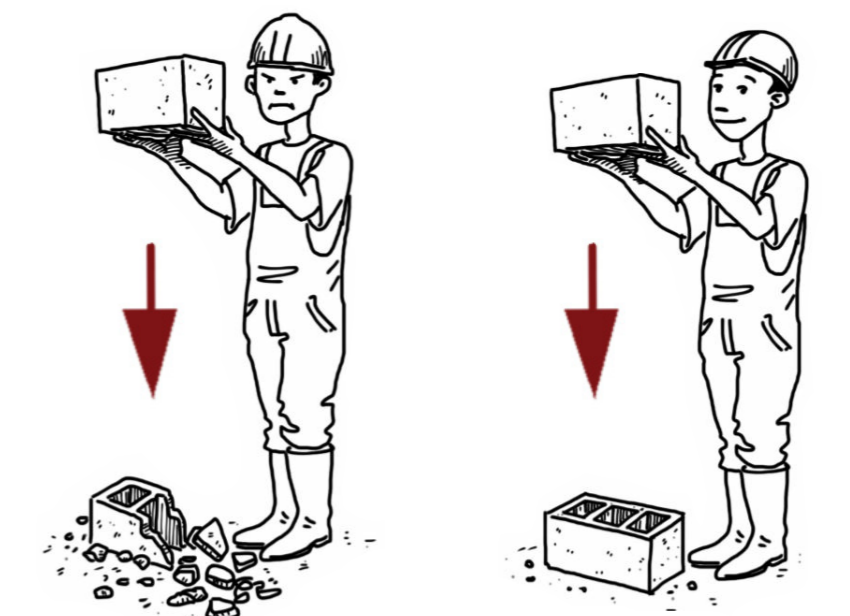
Huecos verticales deben ser menos de 50% de la superficie horizontal.

ancho min 15 cm recomendado 20 cm

**Índices de mala o buena calidad de fabricación de bloques:**  
Los bloques no deben secar en el sol. Los bloques son almacenados bajo una lona o en la sombra.



**Prueba sencilla para bloques de cemento buenos:**  
Deja caer 5 bloques de una altura de 1.5m en una superficie dura (tipo concreto).



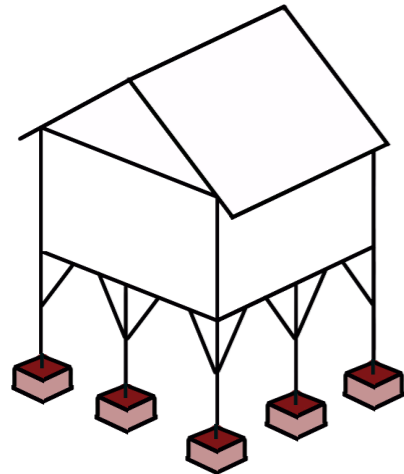
✗ NO  
**Calidad inadmisibile:**  
más de 1 fractura.  
¡No lo compre!

✓ sí  
**Calidad admisible:**  
menos de 1 fractura.



## 4 CONSTRUIR UNA CIMENTACIÓN SÓLIDA

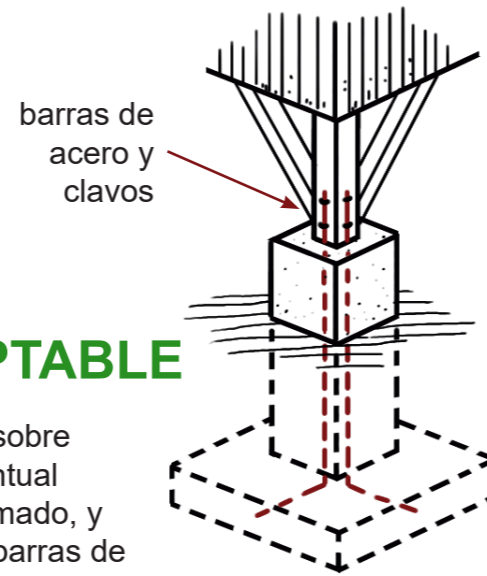
### 4A : CONSTRUCCIÓN ELEVADA



Una casa es más sólida cuando está construida sobre una cimentación sólida.

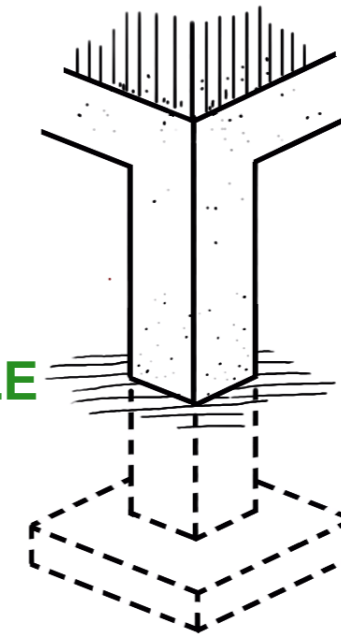
✓ **ACEPTABLE**

Pie de madera sobre cimentación puntual de hormigón armado, y conectado con barras de acero.

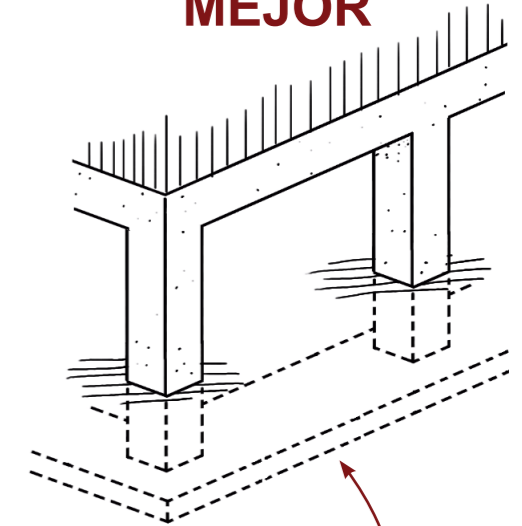


✓ **ACEPTABLE**

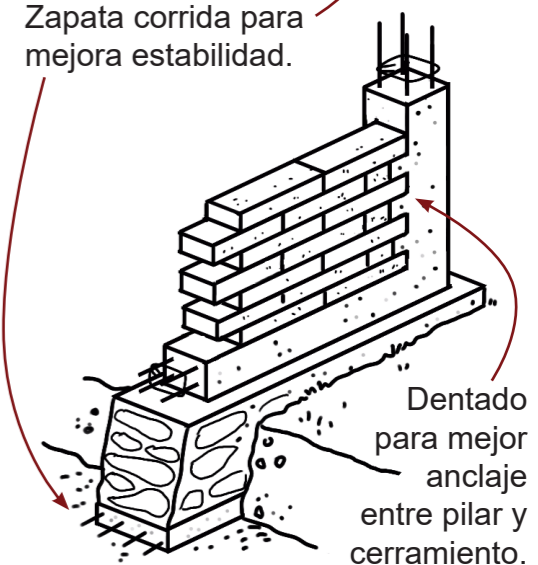
Pilar y cimentación, puntal de hormigón armado.



**MEJOR**

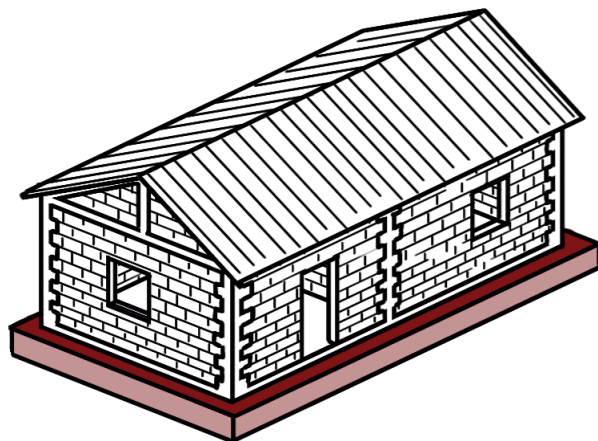


Zapata corrida para mejora estabilidad.



Dentado para mejor anclaje entre pilar y cerramiento.

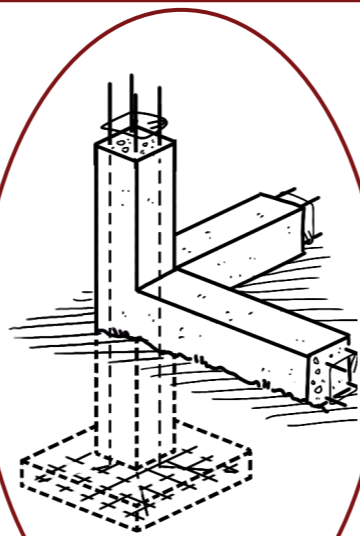
### 4B : CONSTRUCCIÓN PESADA



Una casa es más sólida cuando está construida sobre una cimentación sólida.

Losa de hormigón de 10cm de espesor con retícula de armadura metálica conectada a la viga de cimentación.

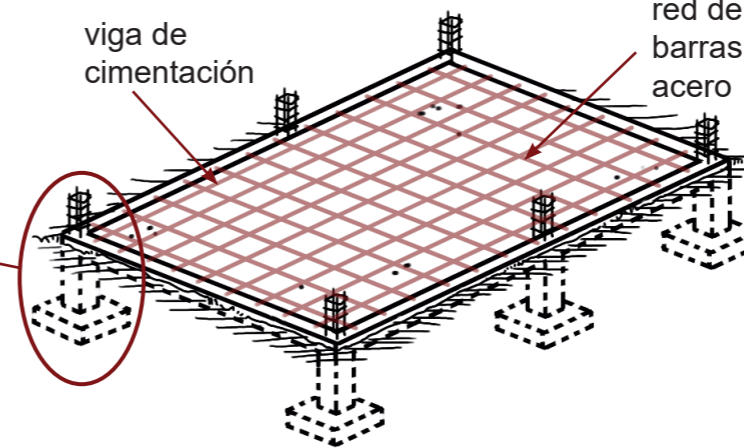
Pilar y cimentación puntual de hormigón armado.



✓ **SÍ**

viga de cimentación

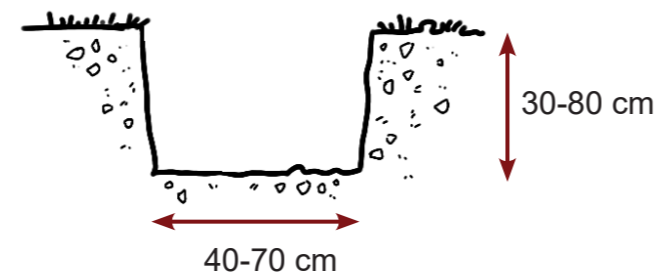
red de barras de acero



### 4C : TIPO DE SUELO



La cimentación debe apoyarse sobre un suelo firme.



Cavar hasta encontrar suelo firme y luego construir la base con el ancho adecuado.



Aplaste sobre un cubo de madera de 3,6 x 3,6 x 3,6 cm.

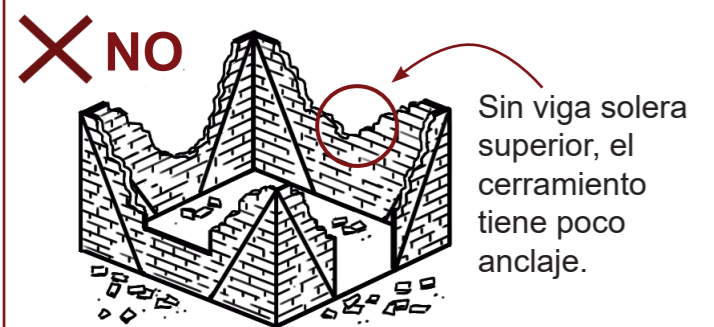
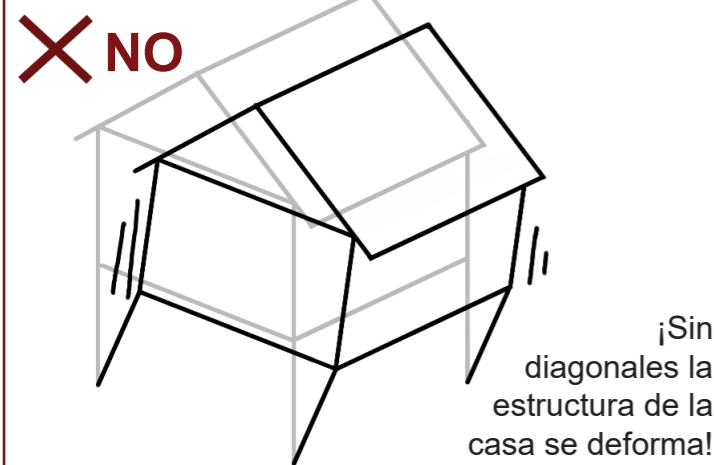
**Prueba rápida de suelo firme:**

En el suelo firme, un cubo de madera de 3.6 x3.6cm no debe hundirse cuando una persona (65kg) esta encima.

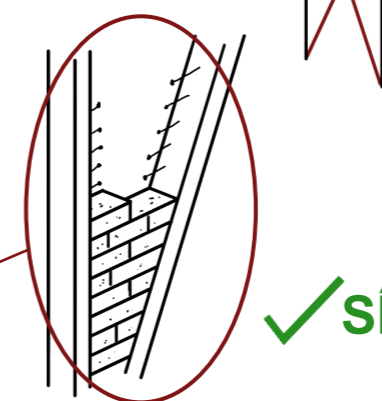
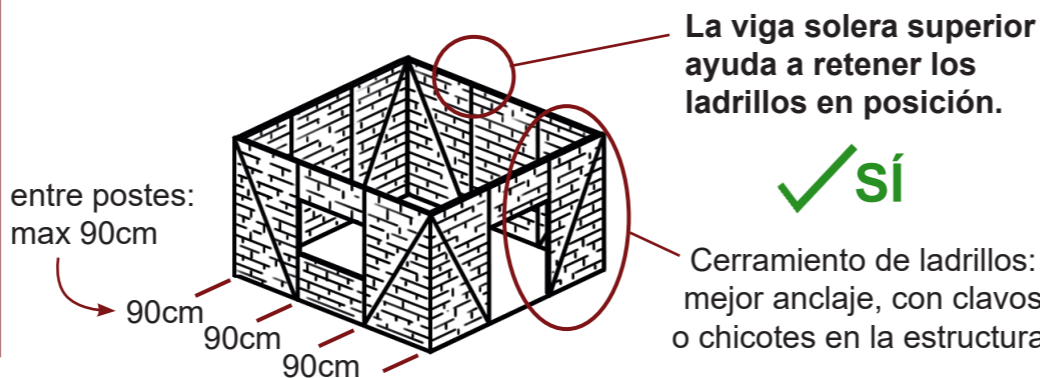
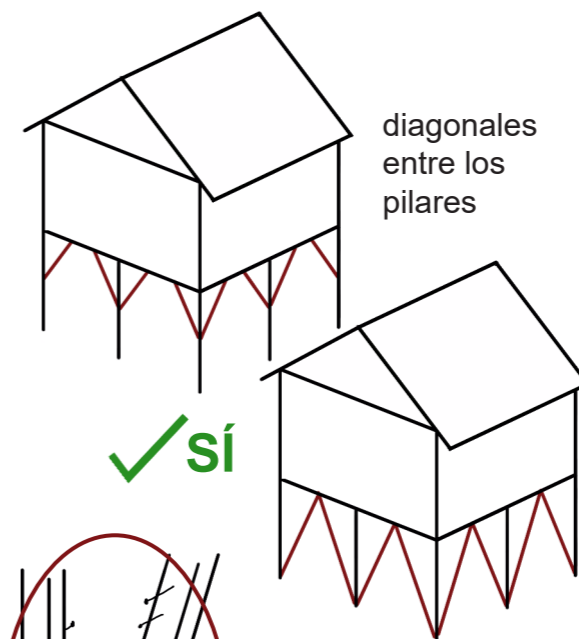
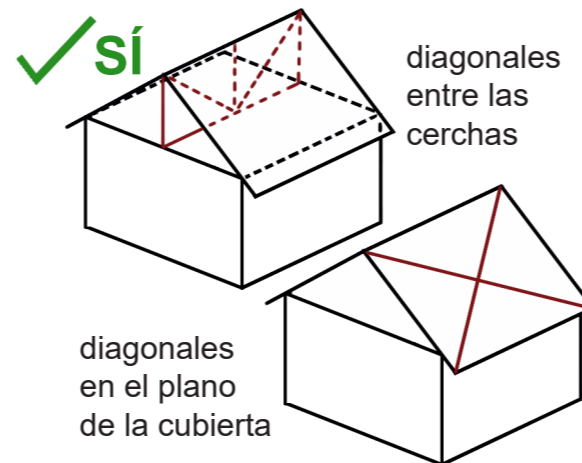
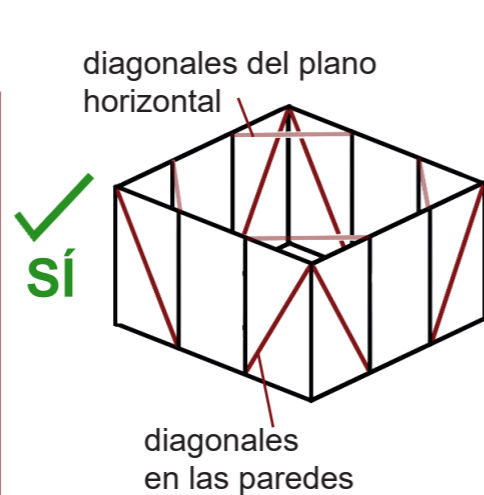
De ser posible es recomendable realizar un estudio de suelo.



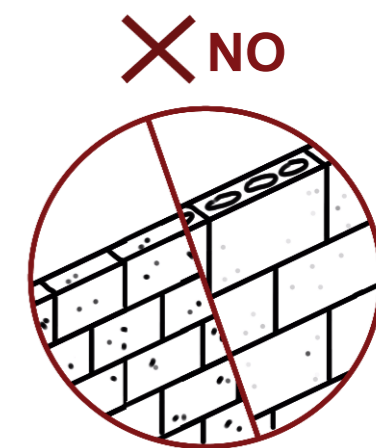
5A: CONSTRUCCIÓN LIVIANA



¡Las diagonales ayudan a rigidizar la estructura!

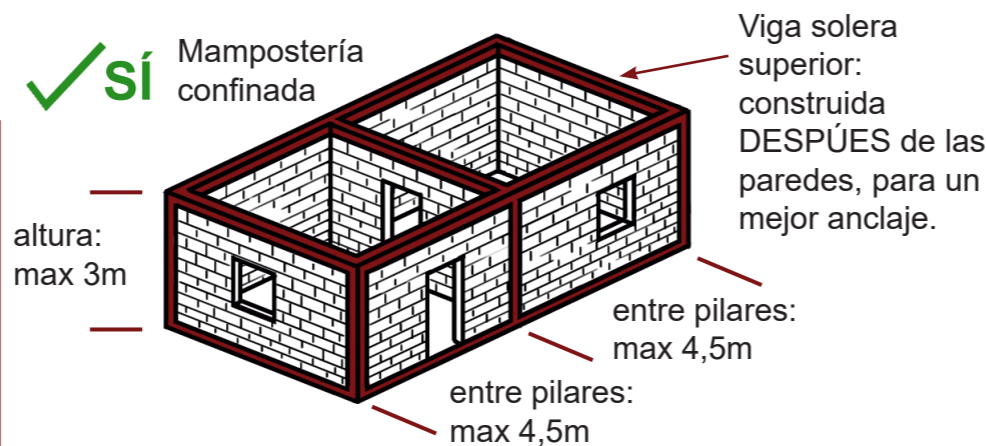
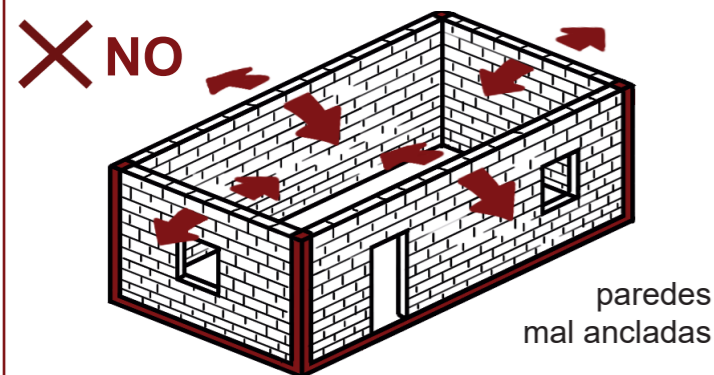


Utilización de ladrillos y bloques

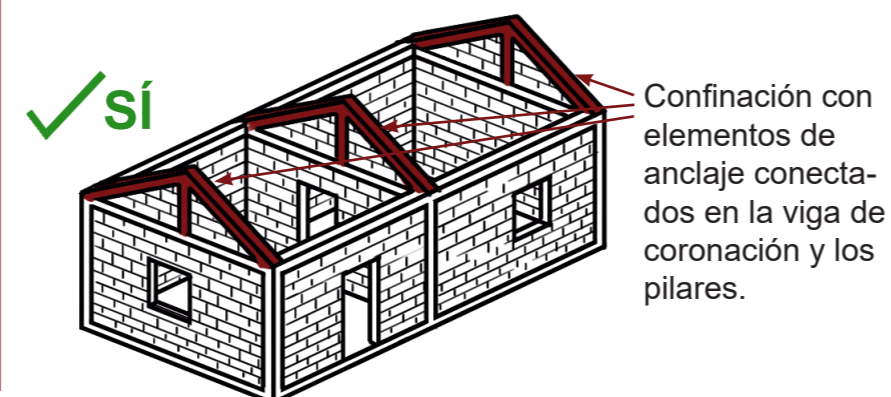
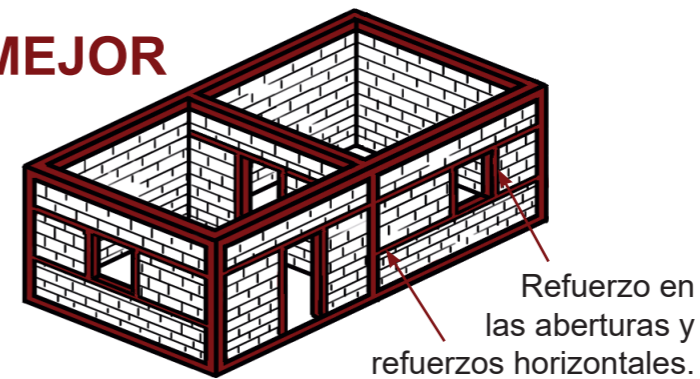


No ladrillos en posición vertical y no bloques de cemento de menos que 10cm de ancho son inestables. ¡Son peligrosos!

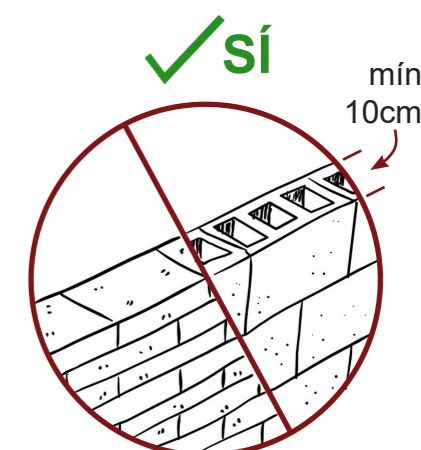
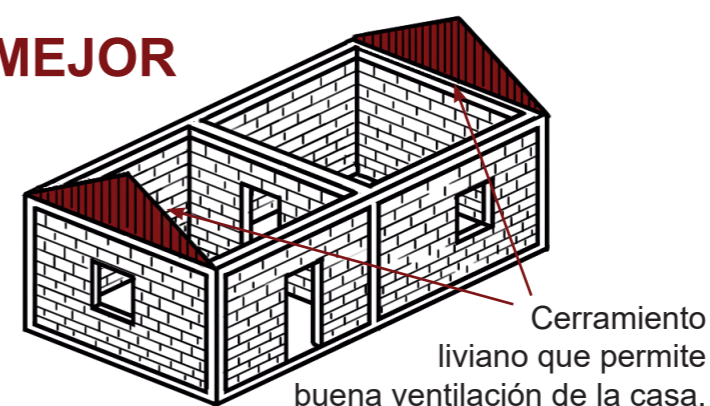
5B : CONSTRUCCIÓN PESADA



MEJOR



MEJOR



Usar ladrillos en posición horizontal o bloques de cemento de mínimo 10cm de ancho.



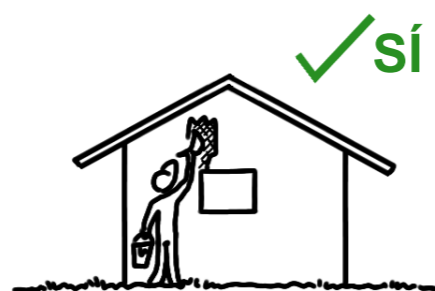
6A : MANTENIMIENTO BÁSICO

El mantenimiento ayuda a extender la vida útil de un edificio. Se hace:

- diariamente: mirando que esta en buen estado general
- anualmente: verificando todo el edificio de manera más completa



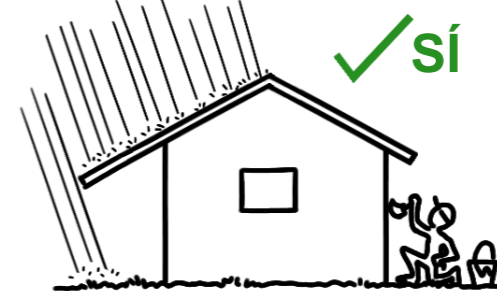
No almacenar madera contra las paredes (genera humedad y bichos).



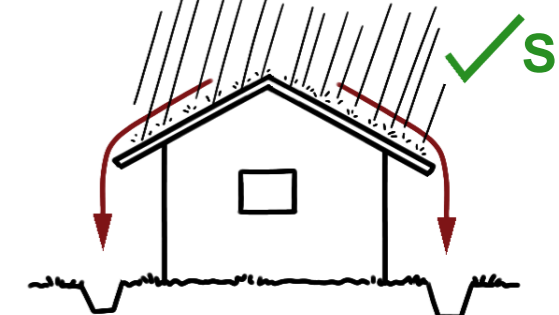
Tratar la madera y la guadúa anualmente contra los bichos (con borato u otros químicos). Posteriormente, colocar una capa de protección adicional contra el agua para que no se parta con la lluvia. Pintar elementos de metal expuestos para evitar corrosión (especialmente en entornos de alta salinidad).



Limpiar cubierta y canaletas.



Proteger elementos de paredes con pintura o con aleros más largos.



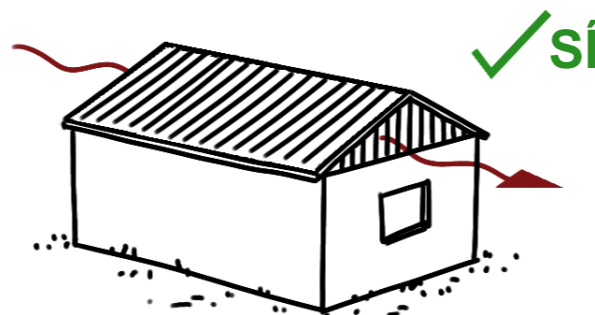
Crear desagües alrededor de la casa para evacuar aguas de lluvia.

El mantenimiento se debe hacer para cada edificio, cualquiera que sean sus materiales de construcción:  
 - mampostería, hormigón, ladrillos, madera, guadúa, quincha, ...

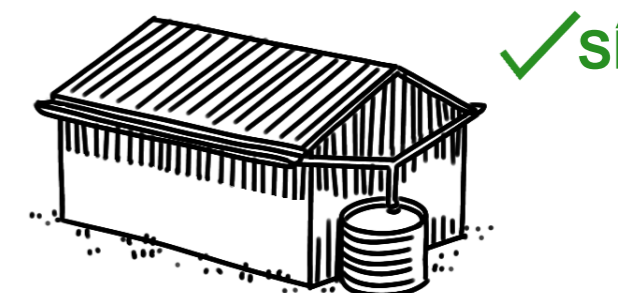
6B : CONFORT Y ENERGÍA

Ahorra dinero viviendo sin aire acondicionado.

Reduce el consumo de agua.



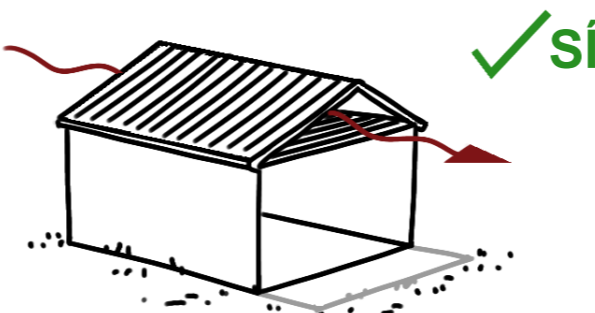
Aberturas situadas en la parte superior de la vivienda permiten la salida natural del aire caliente.



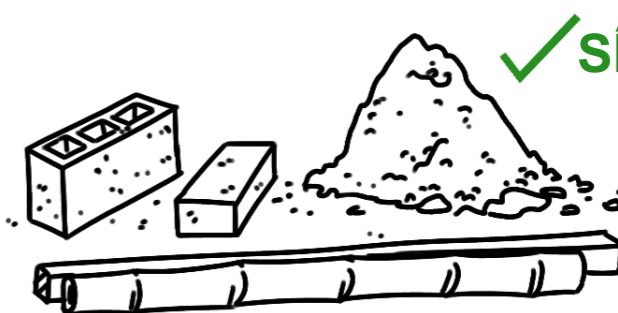
Se puede realizar una recolección de agua de lluvia para optimizar el consumo de agua en la casa (proteger el tanque con un mosquitero o una tapa).



Una cubierta de color más clara no calienta tanto en el sol.



Un falso techo con ventilación ayuda a evitar temperaturas altas en la casa.



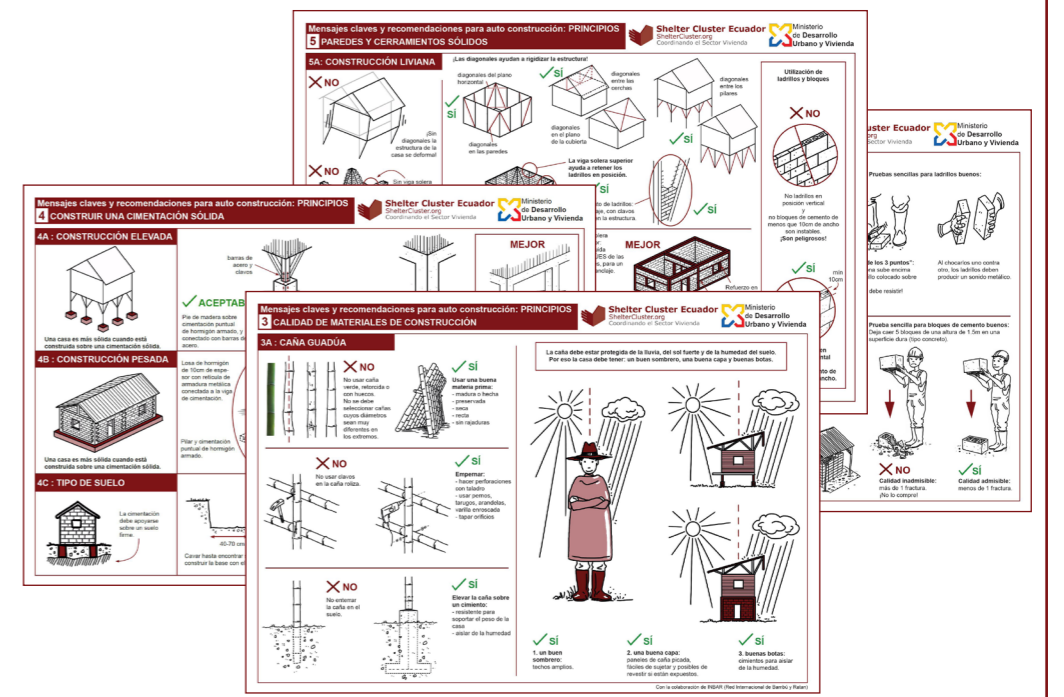
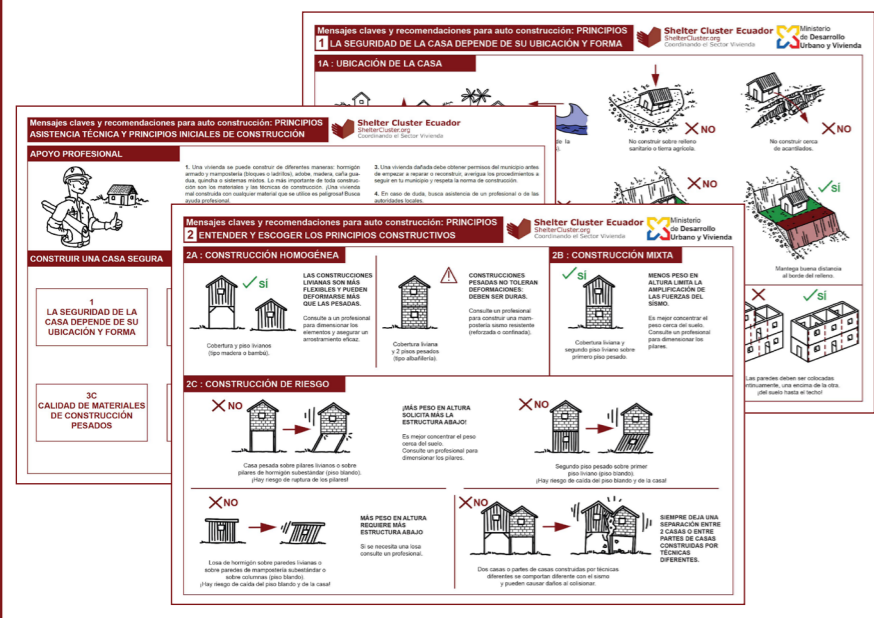
Utilizar materiales de calidad apoyando la economía local.

# Mensajes claves y recomendaciones para auto construcción: DETALLES ASISTENCIA TÉCNICA Y PRINCIPIOS INICIALES DE CONSTRUCCIÓN

## I. PRINCIPIOS DE CONSTRUCCIÓN

Los mensajes claves I (Principios de construcción) están destinados a los no profesionales de la construcción. El objetivo es la contribución a la mejora de la cultura constructiva en la zona afectada por el terremoto del 16 de abril 2016, para evitar que se reproduzcan errores y puntos débiles en el proceso de reconstrucción.

Los mensajes claves tratan la calidad de los materiales de construcción, varias técnicas constructivas livianas y pesadas, e insistan en la importancia de tener un apoyo profesional durante la construcción de un edificio.



## II. DETALLES DE CONSTRUCCIÓN



Este documento comprende los Mensajes Claves II. Los Mensajes Claves II (Detalles de construcción) completan los Mensajes Claves I y están destinados a los profesionales de la construcción en las comunidades de la zona afectada. Son el resultado de la observación de las prácticas constructivas habituales y los errores y puntos flacos más típicos. Pueden resultar de utilidad para aclarar algunos detalles constructivos importantes.

### 1 REGLAS DE SEGURIDAD EN LA OBRA

**2**  
**GUADÚA : CLAVES PARA UNA MATERIA PRIMA DE BUENA CALIDAD**

**3**  
**GUADÚA : CLAVES PARA UNA CONSTRUCCIÓN DE BUENA CALIDAD**

**4**  
**MAMPOSTERÍA : CUADROS Y MAMPOSTERÍA CONFINADA**

**5**  
**MAMPOSTERÍA : CLAVES PARA UNA CONSTRUCCIÓN DE CALIDAD**

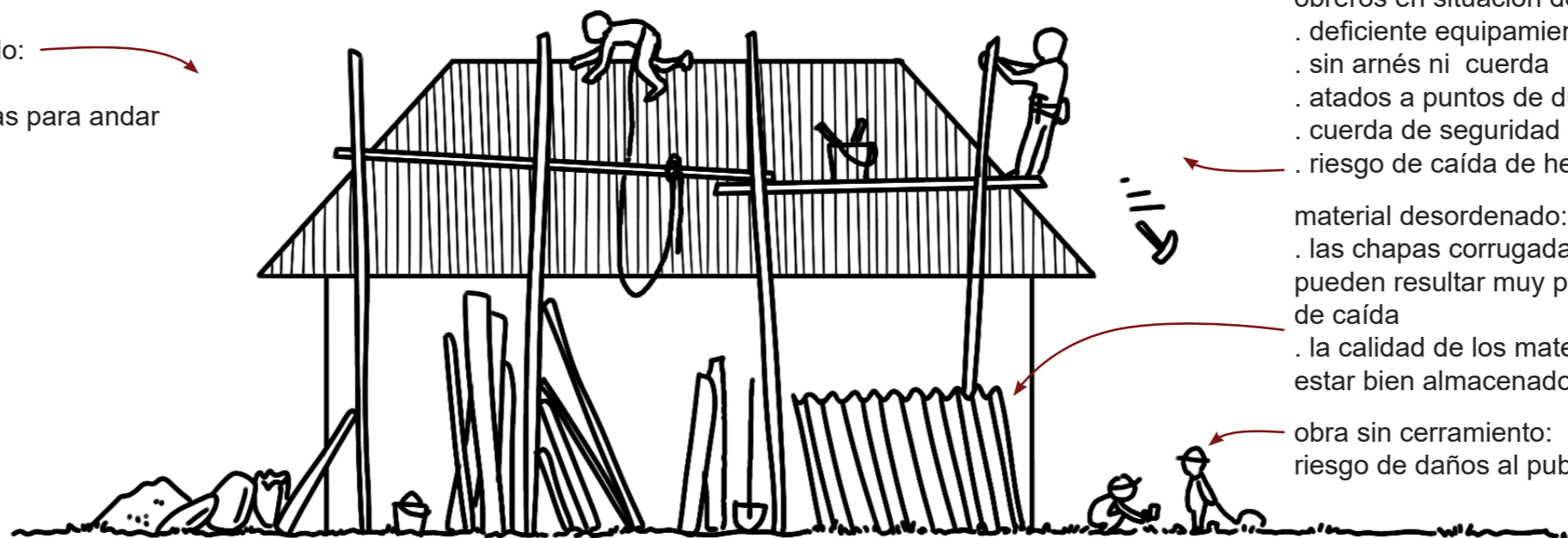


1 REGLAS DE SEGURIDAD EN LA OBRA

1A : OBRA PELIGROSA

NO

andamio improvisado:  
· sin barreras  
· sin planchas o vigas para andar  
· gran inestabilidad



obreros en situación de riesgo:  
· deficiente equipamiento de protección personal  
· sin arnés ni cuerda  
· atados a puntos de dudosa estabilidad  
· cuerda de seguridad demasiado larga  
· riesgo de caída de herramienta o materiales

material desordenado:  
· las chapas corrugadas, planchas y otros materiales pueden resultar muy peligrosos para las personas en caso de caída  
· la calidad de los materiales puede verse alterada de no estar bien almacenados

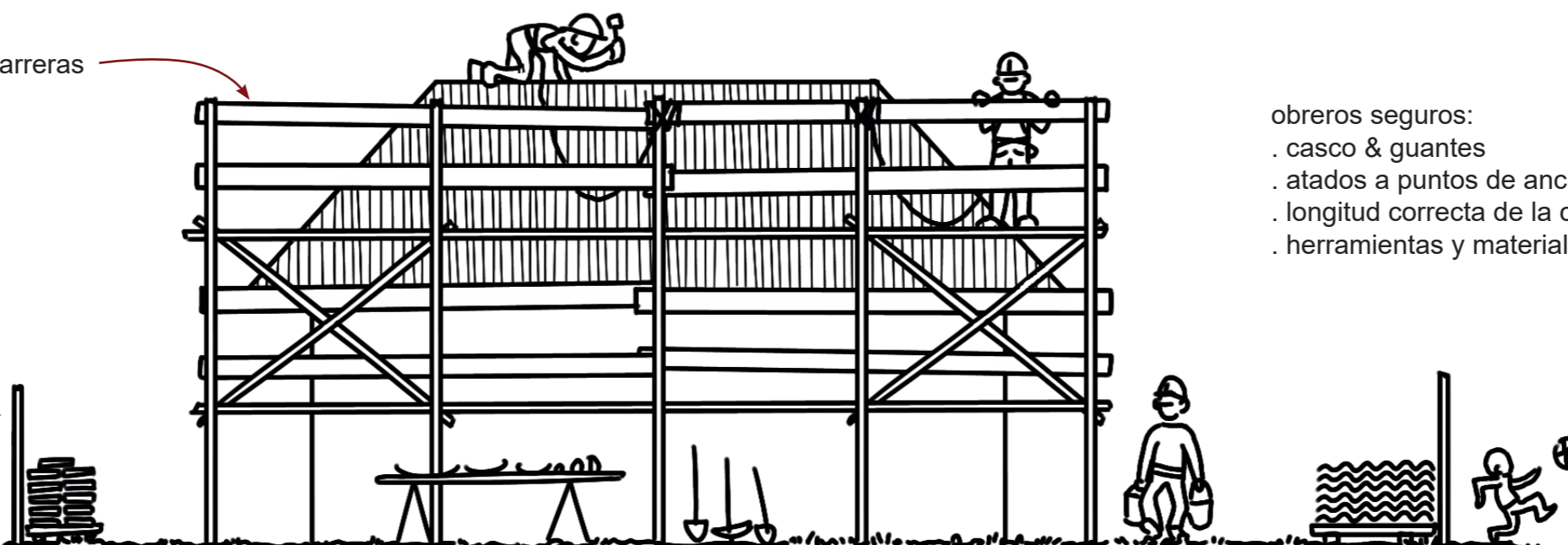
obra sin cerramiento:  
riesgo de daños al público

1B : OBRA SEGURA

SI

barreras

cerramiento



obreros seguros:  
· casco & guantes  
· atados a puntos de anclaje sólidos  
· longitud correcta de la cuerda  
· herramientas y materiales bien almacenados

área de almacenamiento

zona de circulación

área de almacenamiento

zona pública

zona sin acceso al público

zona pública



## 2A : COSECHA

### Sólo se usan tallos maduros:

- . de 4 a 6 años
- . de color verde oscuro, los nodos apenas se ven.
- . líquenes dispersos en el culmo



### Corte de tallos y ramas:

- . mejor en luna menguante y a las primeras horas del día
- . los tallos seleccionados se cortan al ras del primer nodo
- . hacer el corte de ramas evitando que las fibras se desgarran
- . cuidar que los extremos de los tallos no se deterioren por el arrastre



### Selección de los culmos:

- . sin agujeros producidos por aves e insectos
- . no deben presentar bifurcaciones



## 2B : PRESERVACIÓN

### Preservación natural o avinagrado:

- . dejar la caña sobre el mismo tocón o una piedra, durante 3 semanas, dejando ramas y hojas intactas
- . los almidones, azúcares y humedad, propios de la caña, se vuelven alcohol, evitando el ataque de insectos
- . la caña cambia de color de verde a naranja



### Preservación química:

- . se realiza con cañas pre-secadas (el pre-secado se hace durante una semana como máximo)
- . realizar una inmersión en sales de bórax y ácido bórico
- . más eficaz, con menor costo
- . más segura para el ambiente



### Método:

- . perforar las cañas con una varilla de acero
- . lavar el tallo con materiales que no rayen la piel



- . introducir las cañas en el tanque donde está el preservante
- . mezcla: por cada 96 litros de agua + 2 kg de bórax + 2 kg de ácido bórico



- . colocar el extremo superior del culmo cerca de la superficie del líquido para que el aire contenido salga



- . sumergir en la mezcla durante 5 días a temperatura ambiente o 6 horas si se tiene una temperatura de 60°C



- . sacar y colocar de forma inclinada con la base hacia arriba para que se escurra el líquido

## 2C : SECADO

- . La guadúa para la construcción debe alcanzar un contenido de humedad igual o inferior a la humedad del lugar

- . El secado puede hacerse al aire libre o secado al sol



### Secado sobre caballete:

- . apoyar las cañas sobre un caballete para aislar los culmos del contacto con el suelo

- . girar diariamente las cañas para un secado uniforme (los primeros 15 días y después de manera menos frecuente)



- . tiempo de secado: entre 2 y 6 meses según las condiciones climáticas

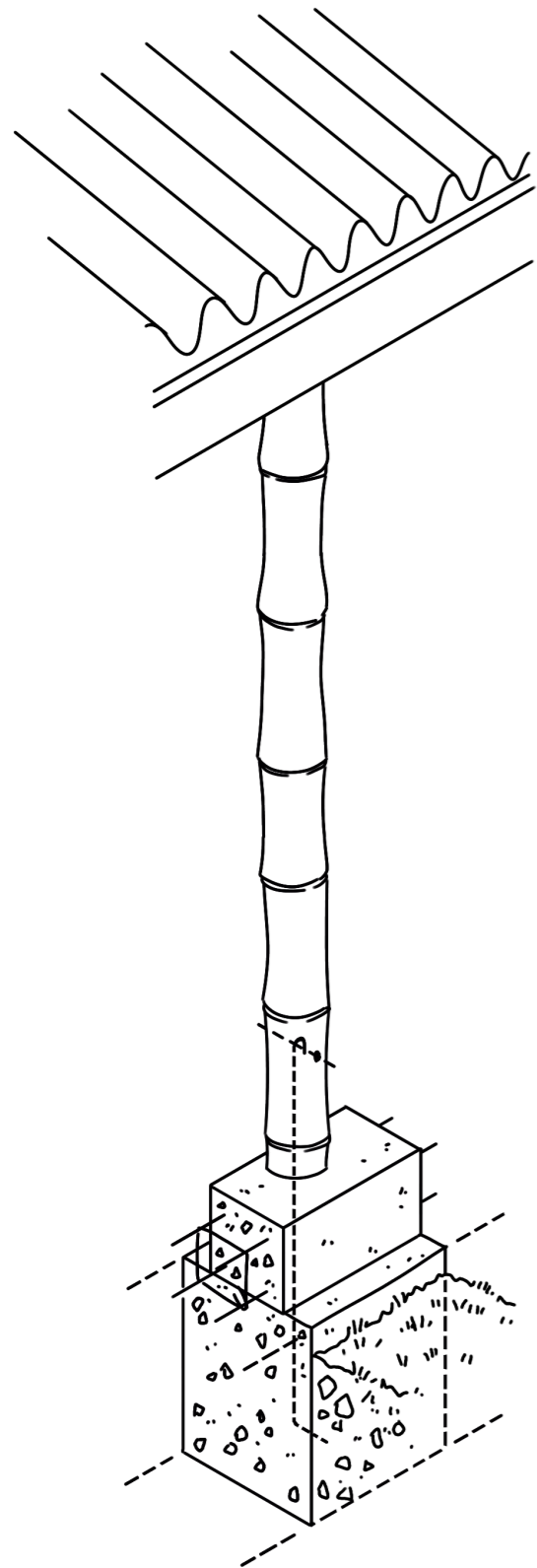
### Secado y almacenamiento bajo techo:

- . proteger las cañas secas del contacto directo del sol, colocando separadores para facilitar el buen flujo de aire





**3A : ELEMENTOS DE LA CASA**



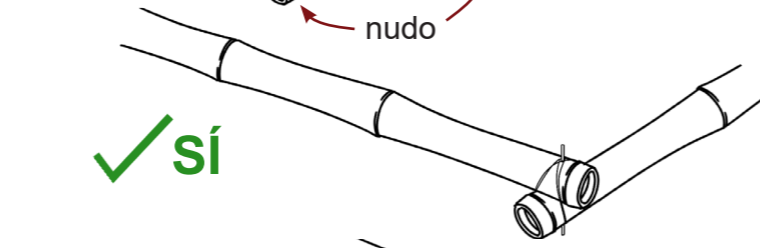
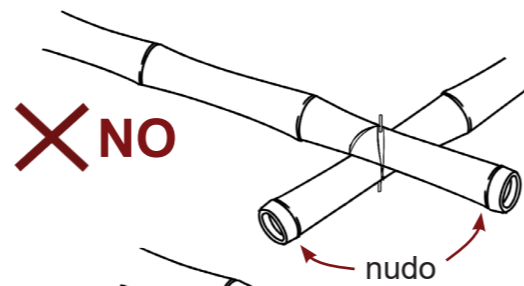
Cubierta / techo de aleros generosos

Estructura portante

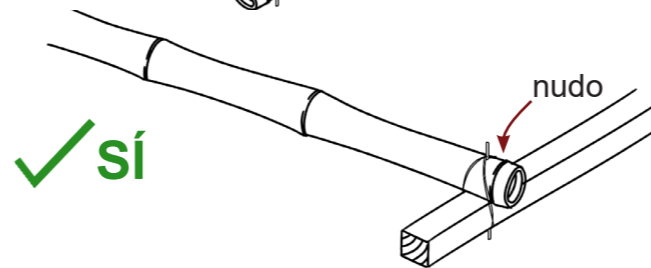
Pisos

Sobre cimientos

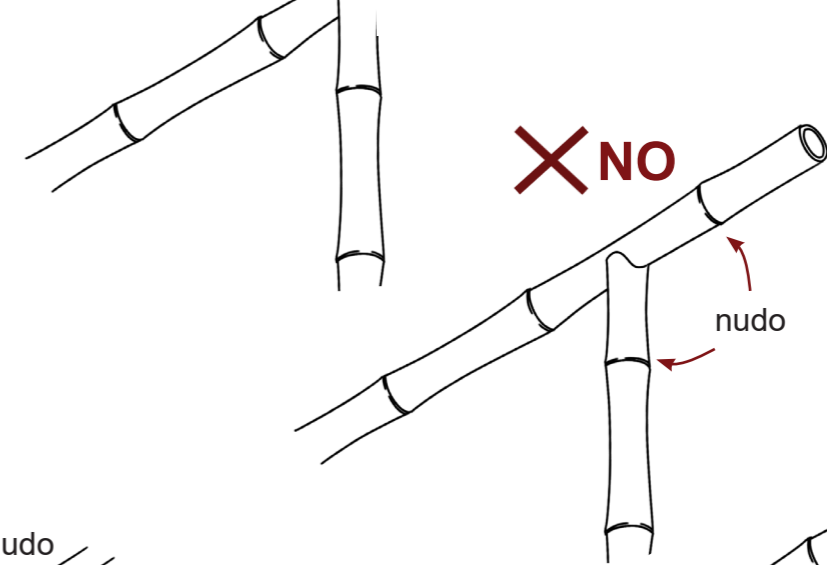
**3B: CONEXIONES Y NUDOS**



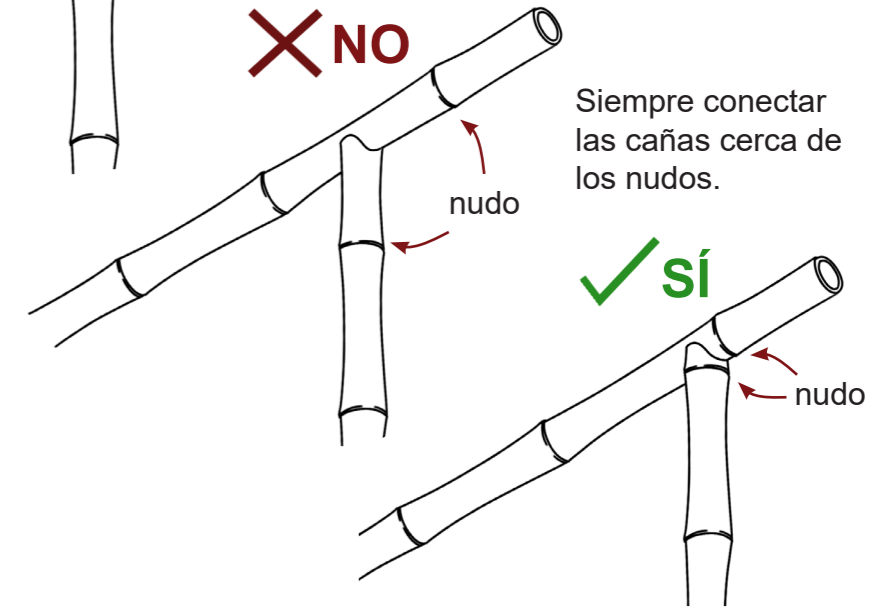
Siempre conectar las cañas cerca de los nudos.



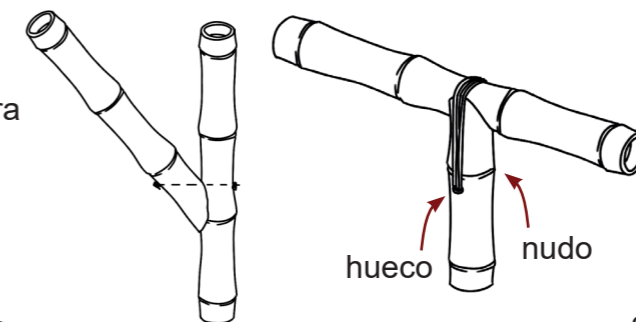
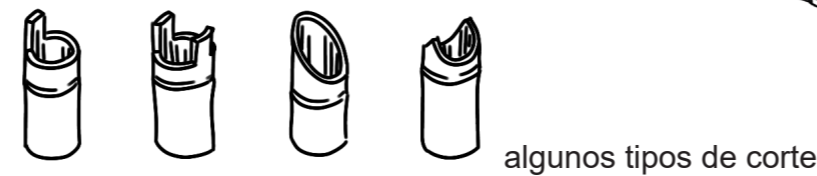
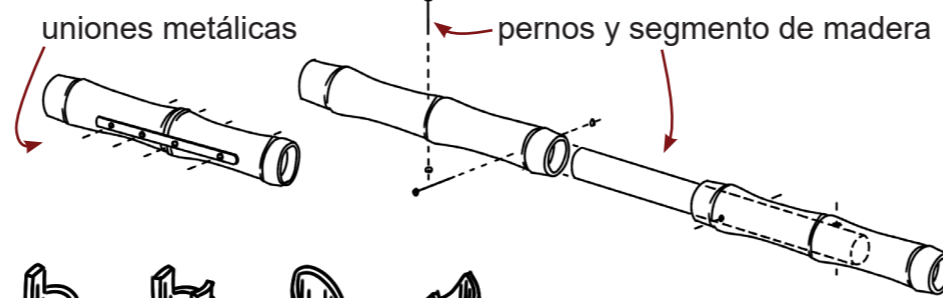
Siempre dejar un nudo después de la conexión.



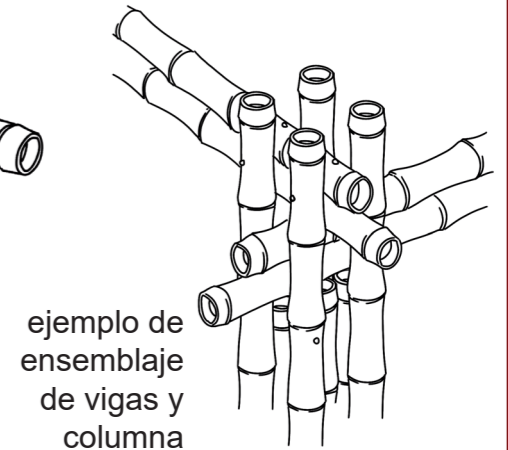
Siempre conectar las cañas cerca de los nudos.



**3C: EJEMPLOS DE ENSAMBLAJE**



Cuando hay cargas en la parte alta, es mejor usar mortero en las uniones para evitar aplastamientos.



ejemplo de ensamblaje de vigas y columna

**3D: PROTECCIÓN DE LA CAÑA**



Usar pintura esmaltada en metales y caña expuesta.

Revestir paredes expuestas (mortero de cemento, arena y cal o quincha).



Sellar cavidades en los extremos de los culmos con mortero de cemento, arena y cal.



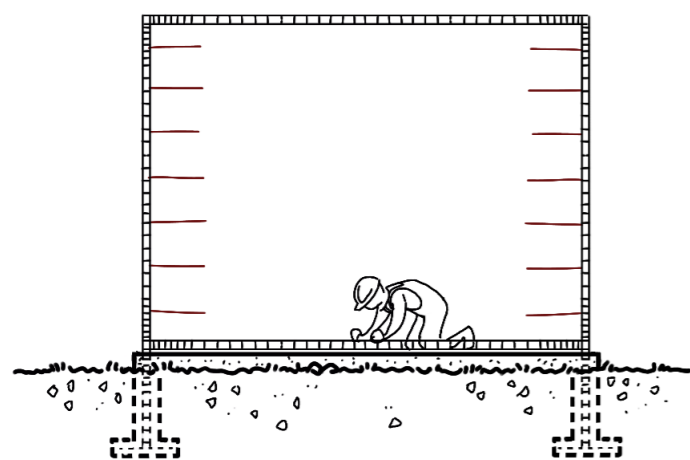
Cortar y lijar sobrantes de pernos y protegerlos con anticorrosivos. Reajustarlos cada 6 meses.



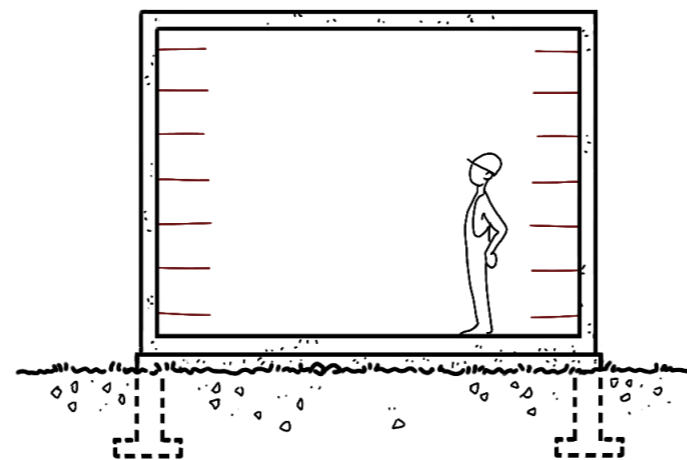


4A : PÓRTICOS DE HORMIGÓN

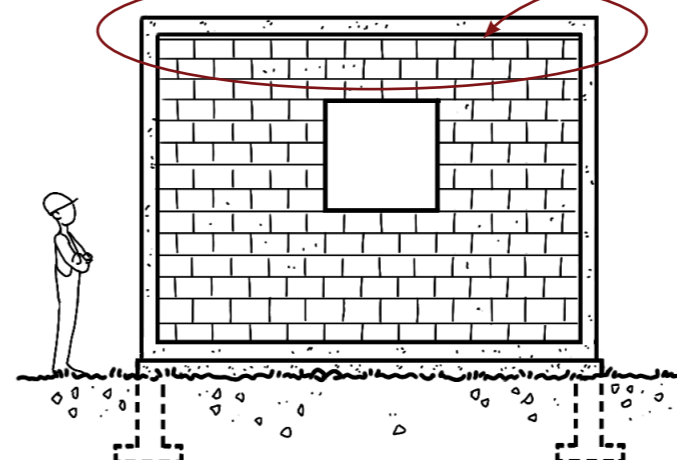
Esta manera de construir es muy común pero tiene riesgos si no esta bien hecha.



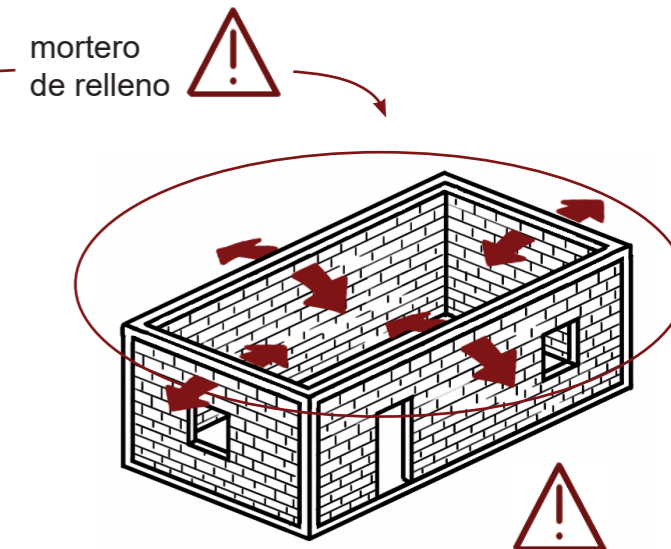
1. Se construye la armadura de varillas de acero con chicotes para anclar el cerramiento de bloques o de ladrillos.



2. Se hace el encofrado y el hormigón. Se obtiene un pórtico de hormigón armado listo para el cerramiento.



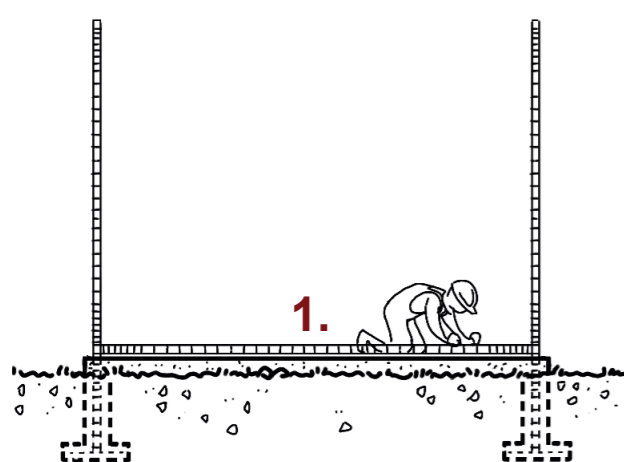
3. Se hace el cerramiento de bloques o de ladrillos, con los chicotes en el mortero.



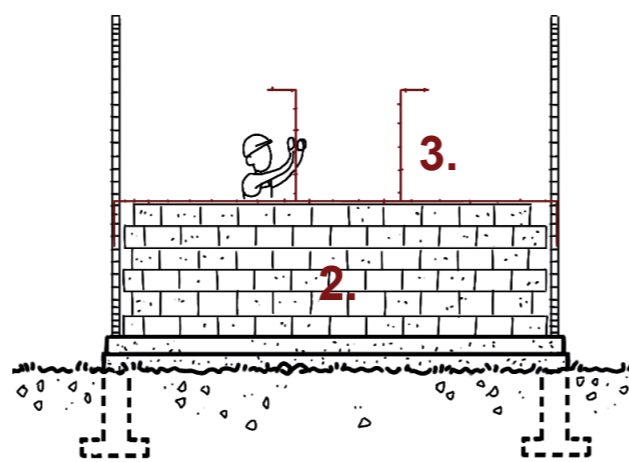
El anclaje entre la viga solera superior y el cerramiento está débil y tiene un riesgo de caída.

4B : MAMPOSTERÍA CONFINADA

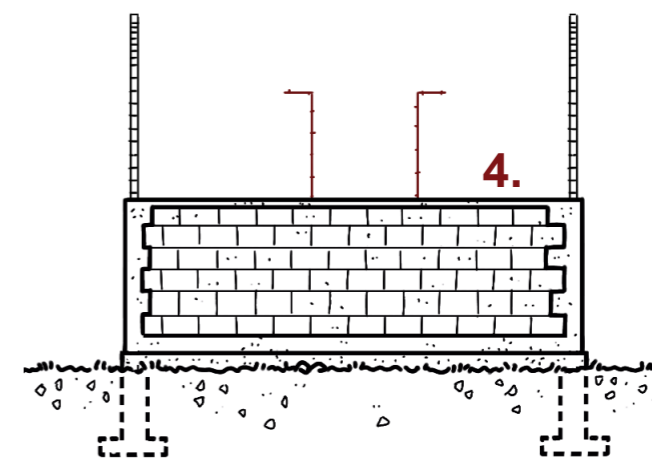
La mampostería confinada permite una construcción más resistente en caso de terremotos.



1. Después de la cimentación se construye la armadura de varillas de acero horizontal inferior y vertical, bien anclada en la cimentación.

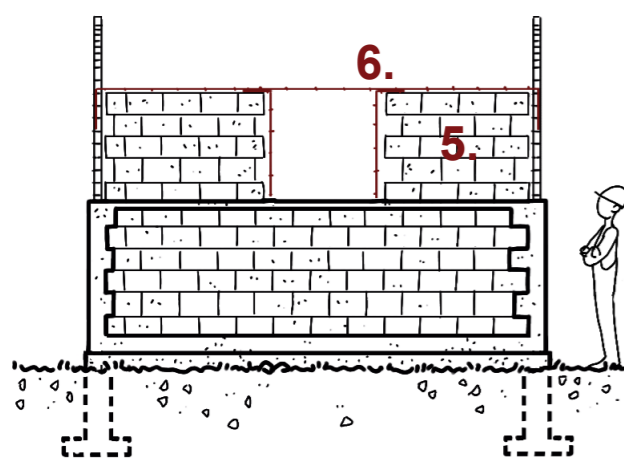


2. Se construye el cerramiento de bloques o ladrillos (altura máx 1,20m) con dentado.



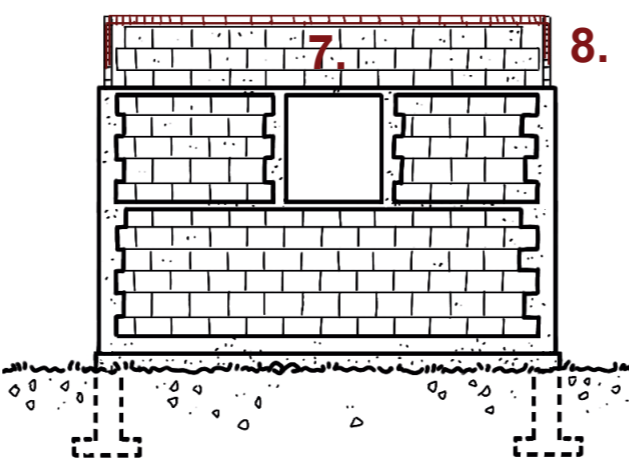
3. Se pone una armadura horizontal intermedia (banda sísmica) y refuerzos verticales para las aberturas.

4. Se vierte la primera parte con hormigón. Una vez fraguado se puede colocar el siguiente nivel de bloques.



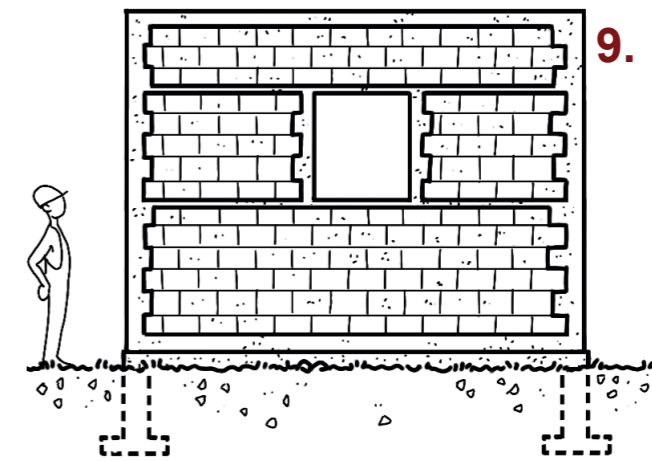
5. Se construye el segundo cerramiento de bloques o ladrillos (altura máx 1,20m) con dentado.

6. Se pone una armadura horizontal intermedia, bien anclada con las columnas.



7. Si es necesario se construye el tercer cerramiento de bloques o ladrillos con dentado.

8. Se pone la armadura horizontal de la viga solera superior, bien anclada con las columnas.

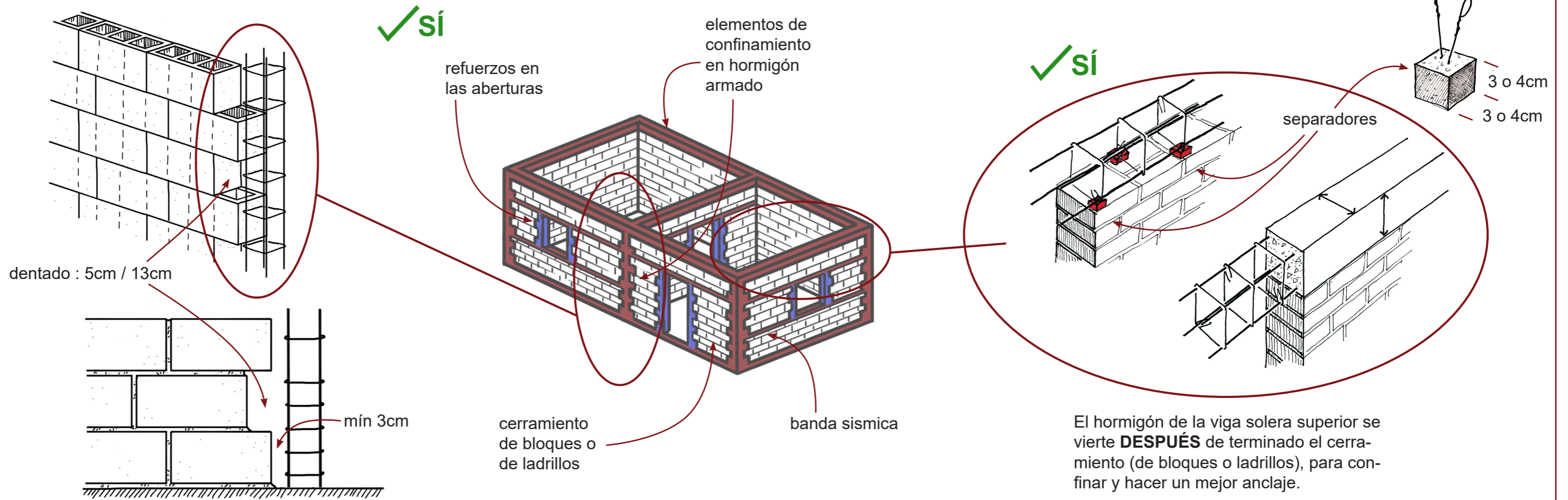


9. Solo al final se hace el hormigón de la viga solera superior, para acabar de confinar la pared (sin el mortero de relleno).



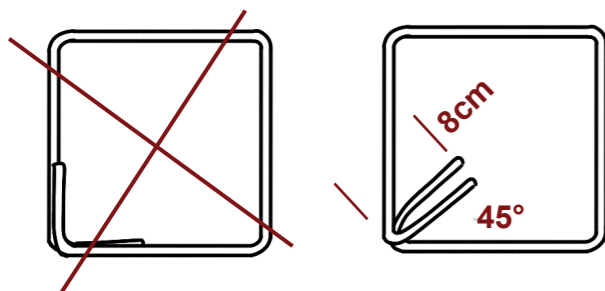
5A : EL ANCLAJE DEL CERRAMIENTO

Es importante tener un buen anclaje entre los elementos de confinamiento en hormigón y el cerramiento de bloques o de ladrillos: para ayudar a este, el dentado y la viga solera superior son claves.



5B: VARILLAS DE ACERO

Estribos: siempre doblar 8 cm a 45°

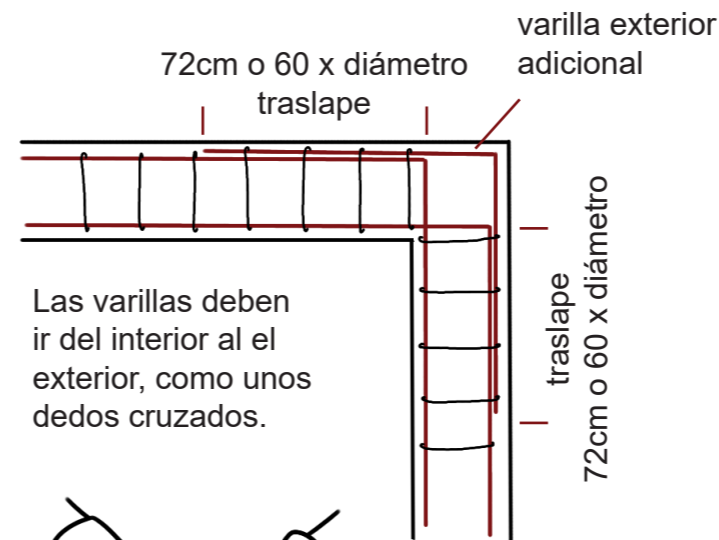


X NO

✓ SÍ

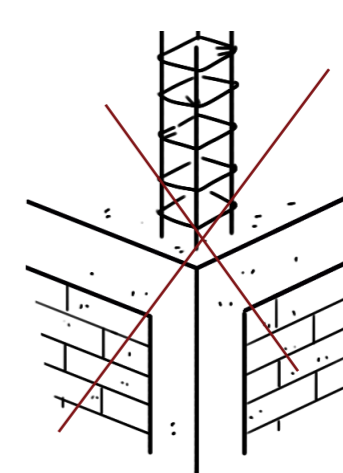


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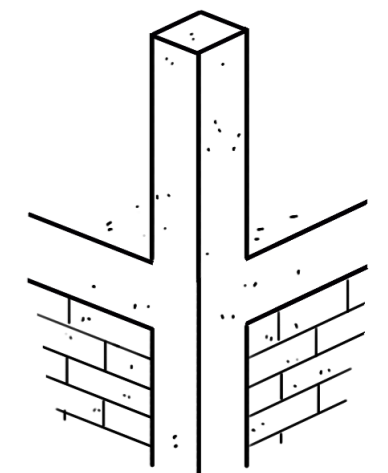


✓ SÍ

“Varillas de la esperanza”  
Las varillas para ampliación de la casa deben ser protegidas con hormigón por la corrosión.



X NO



✓ SÍ