



Faculdade de
Arquitetura e Urbanismo


1952 – 2022



ARQUITETURA E CRISE

TÉCNICAS CONSTRUTIVAS PARA ABRIGOS PÓS-CATÁSTROFES NATURAIS

PROF. DR. ALEXANDRE AUGUSTO MARTINS

[XIX SVM – 2022.2S]

TECENDO UM LAR
[ARCHDAILY, 2022]

CONTEÚDO

- desastres naturais: definições e classificação geral
- desastres em números:
 - ocorrências
 - impacto humano
 - perdas econômicas
- tempos de atenção: do risco à realidade
- abrigos pós-acidentes naturais x técnicas construtivas:
 - projetos propostos
 - obras construídas
 - aproximações possíveis

DESASTRES NATURAIS

DEFINIÇÕES

Uma situação ou um evento que sobrecarrega a capacidade local, necessitando de um pedido de assistência externa a nível nacional ou internacional; um evento imprevisto e muitas vezes súbito que causa grandes danos, destruição e sofrimento humano

[CRED (CENTRE FOR RESEARCH ON THE EPIDEMIOLOGY OF DISASTERS) – INSTITUTE HEALTH AND SOCIETY – UCLouvain], 2021, p. 8]

Resultado de eventos adversos, naturais ou provocados pelo homem, sobre um ecossistema (vulnerável), causando danos humanos, materiais e/ou ambientais e consequentes prejuízos econômicos e sociais [...]

[CASTRO, 1998, p. 52]

Materialização dos riscos existentes que não foram devidamente previstos ou mitigados, sendo causados a partir de vulnerabilidades da sociedade atingida. Nesse ponto de vista, os fenômenos naturais, como tempestades, inundações, furacões etc., atuam como agentes desencadeadores

[ANDERS, 2007, p. 32]

DEFINIÇÕES



danos / consequências; convivência / superação; recursos internos / externos



súbitos / graduais / por somação de efeitos parciais; naturais / humanos / mistos

CLASSIFICAÇÃO

biológicos

epidemias

infestações por
insetos

ataques animais

geofísicos

terremotos

vulcões

movimentos de
massa (sem água)

climatológicos

secas

temperaturas

extremas

incêndios

hidrológicos

inundações

movimentos de
massa (com água)

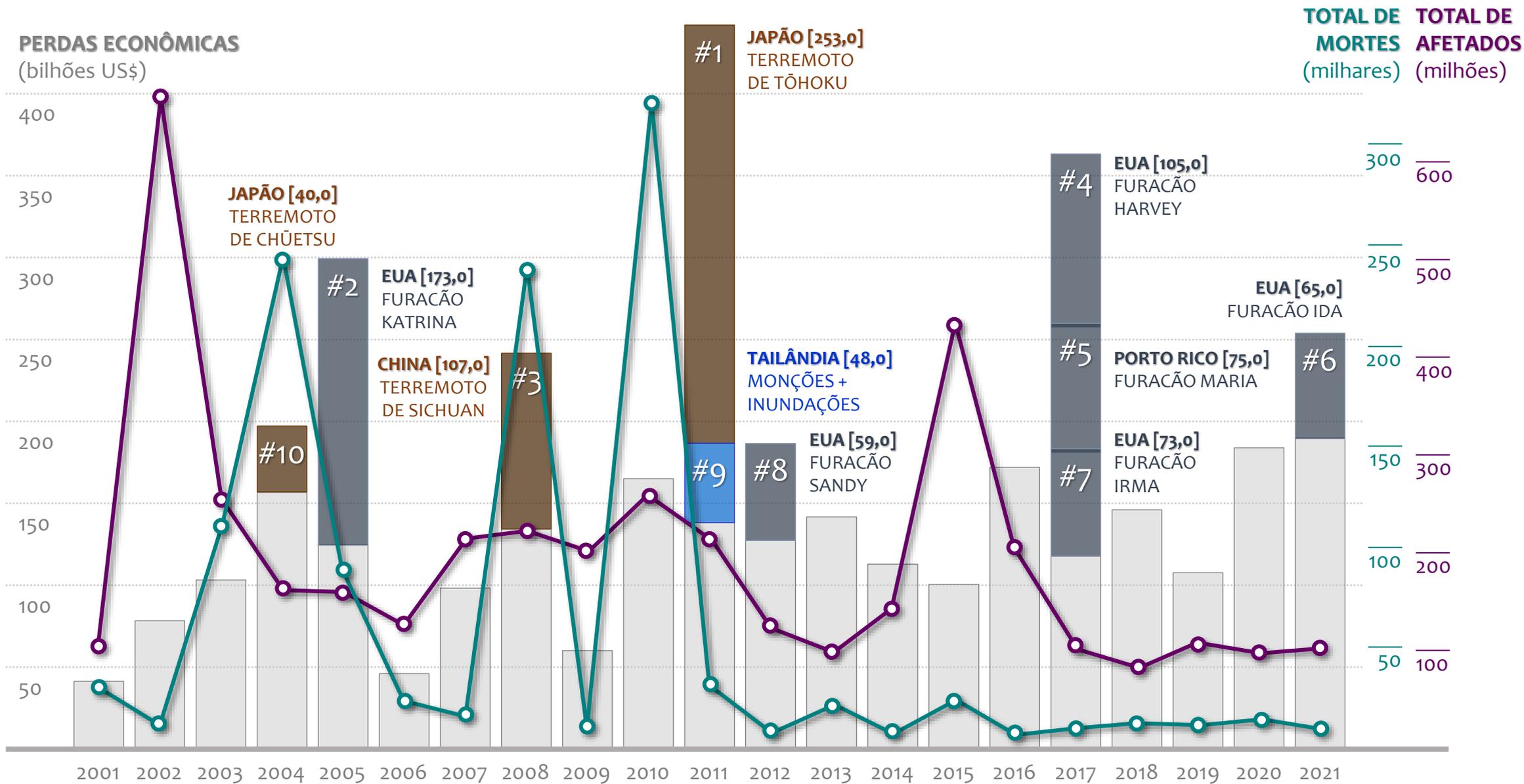
meteorológicos

tempestades

furacões

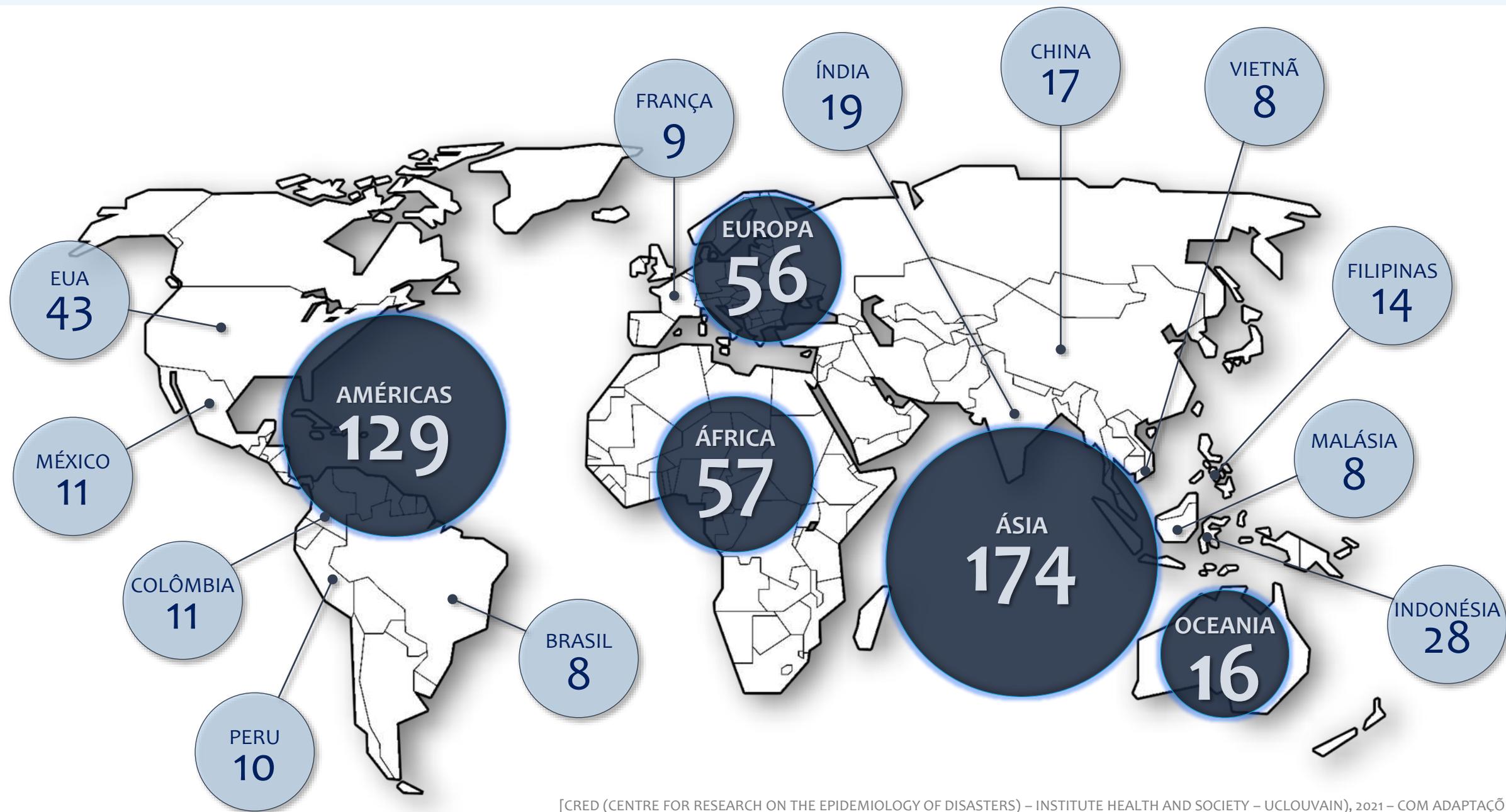
DESASTRES EM NÚMEROS

DEZ PRINCIPAIS PERDAS ECONÔMICAS + CONSEQUÊNCIAS DE DESASTRES (2001 – 2021)



OCORRÊNCIAS DE DESASTRES

NÚMERO DE DESASTRES POR CONTINENTE, E PRINCIPAIS PAÍSES COM ACIDENTES NATURAIS EM 2021



OCORRÊNCIA POR TIPO DE DESASTRE: 2021 X 2001 ... 2020¹

SECAS
15 X 16



TERREMOTOS
28 X 27



TEMPERATURAS
EXTREMAS
3 X 21



INUNDAÇÕES
223 X 163



DESLIZAMENTOS
14 X 18



MOVIMENTOS DE
MASSA (SECOS)
0 X 1



TEMPESTADES
121 X 102



ATIVIDADES
VULCÂNICAS
9 X 5

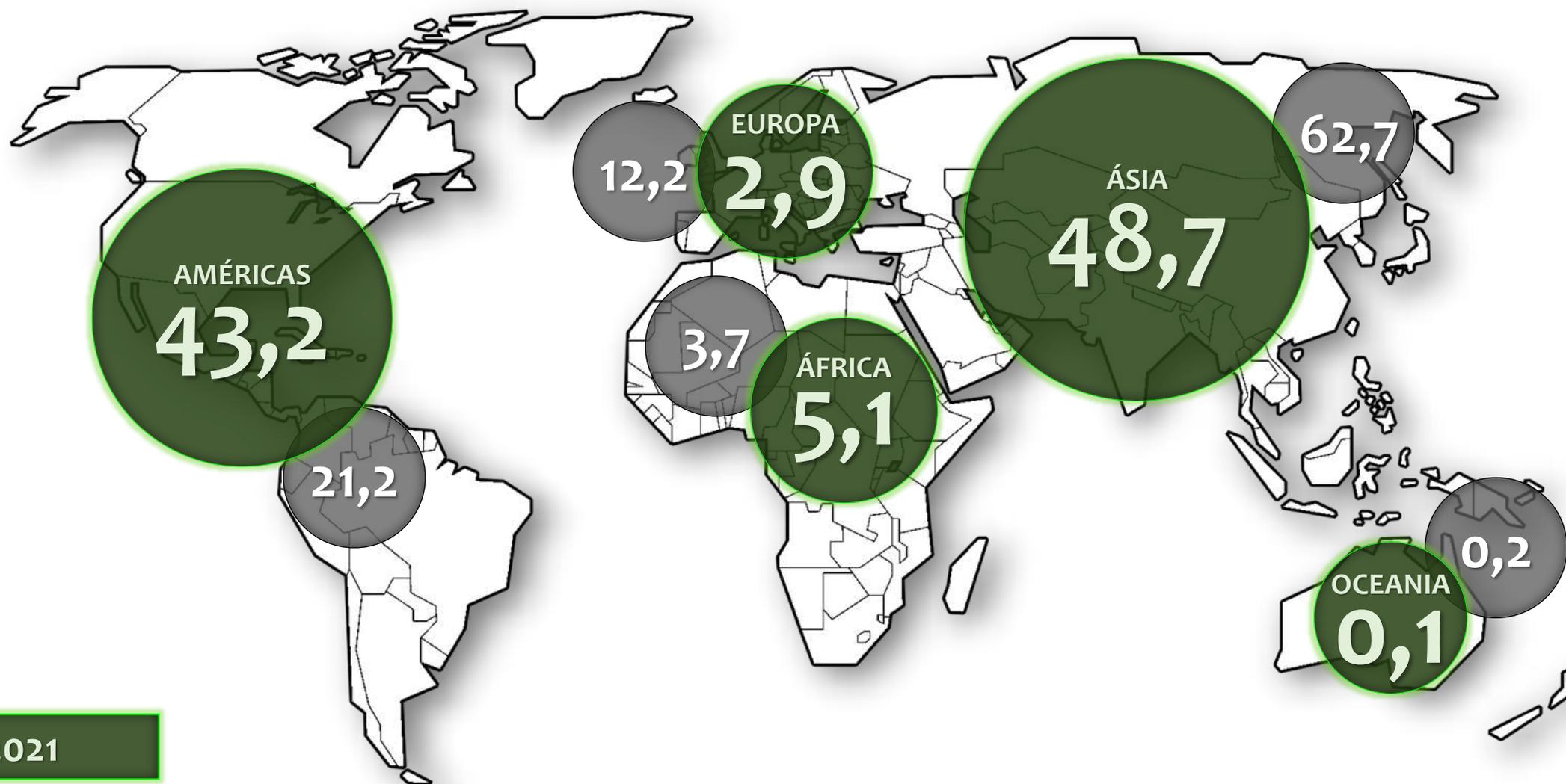


INCÊNDIOS
19 X 11

2021 = **432 X 364** = 2001 ... 2020

IMPACTO HUMANO: TOTAL DE MORTES

PARTICIPAÇÃO NO TOTAL GERAL DE MORTES¹, POR CONTINENTE, EM 2021



2021

2001 ... 2020

NÚMERO DE MORTES POR TIPO DE DESASTRE: 2021 X 2001 ... 2020¹

SECAS
0 X 1059



TERREMOTOS
2742 X 37942



TEMPERATURAS
EXTREMAS
1044 X 8684



INUNDAÇÕES
4143 X 5185



DESLIZAMENTOS
474 X 884



MOVIMENTOS DE
MASSA (SECOS)
0 X 37



TEMPESTADES
1876 X 10442



ATIVIDADES
VULCÂNICAS
85 X 89

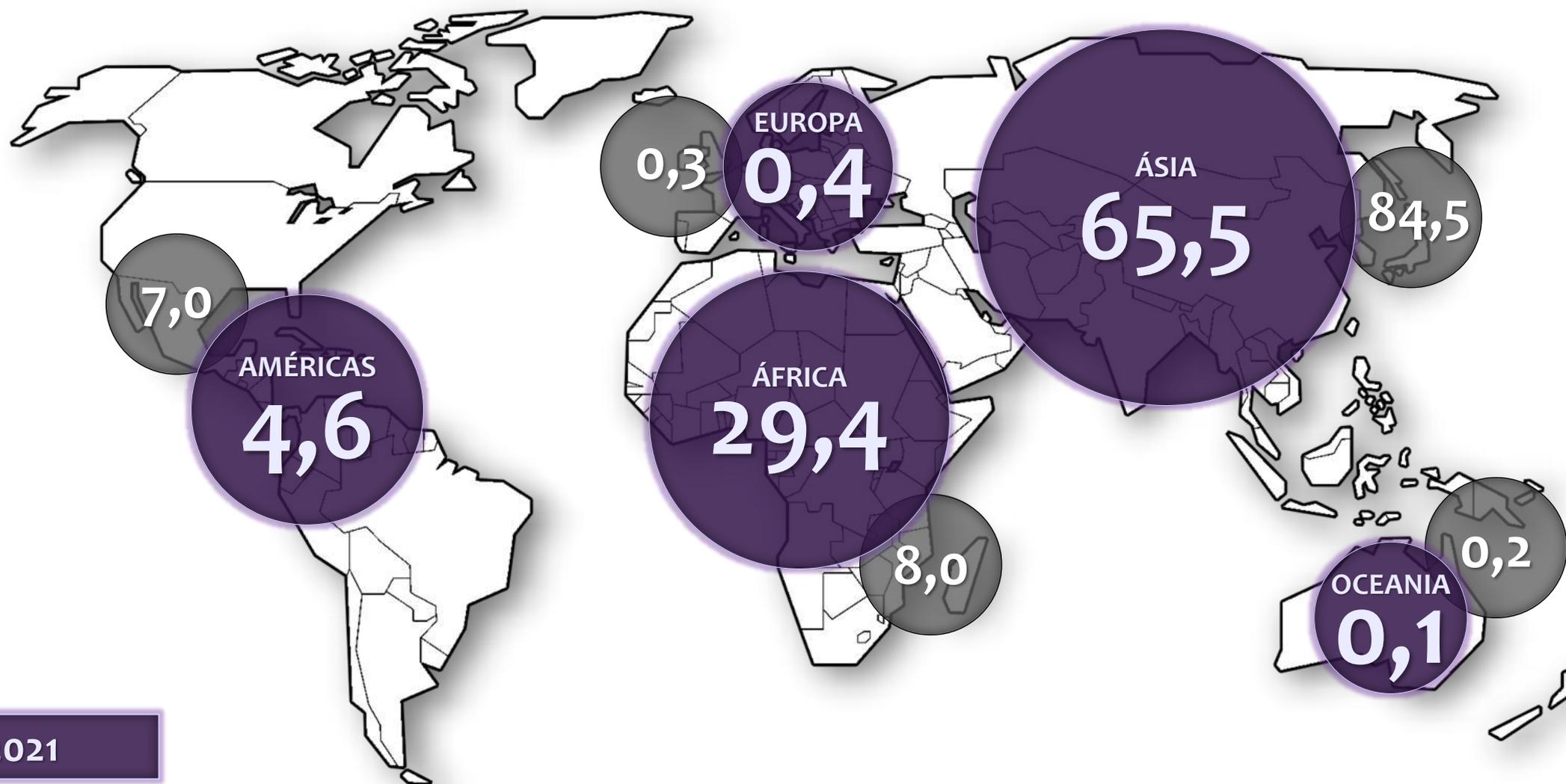


INCÊNDIOS
128 X 77

2021 = **10492 x 64399** = 2001 ... 2020

IMPACTO HUMANO: TOTAL DE AFETADOS

PARTICIPAÇÃO NO TOTAL GERAL DE AFETADOS¹, POR CONTINENTE, EM 2021



2021

2001 ... 2020

NÚMERO DE AFETADOS¹ POR TIPO DE DESASTRE: 2021 X 2001 ... 2020²

SECAS
52,7 X 67,5



TERREMOTOS
1,1 X 6,2



TEMPERATURAS
EXTREMAS
0,0 X 5,1



INUNDAÇÕES
29,2 X 82,7



DESLIZAMENTOS
0,0 X 0,2



MOVIMENTOS DE
MASSA (SECOS)
0,0 X 0,0



TEMPESTADES
17,6 X 37,4



ATIVIDADES
VULCÂNICAS
0,5 X 0,3

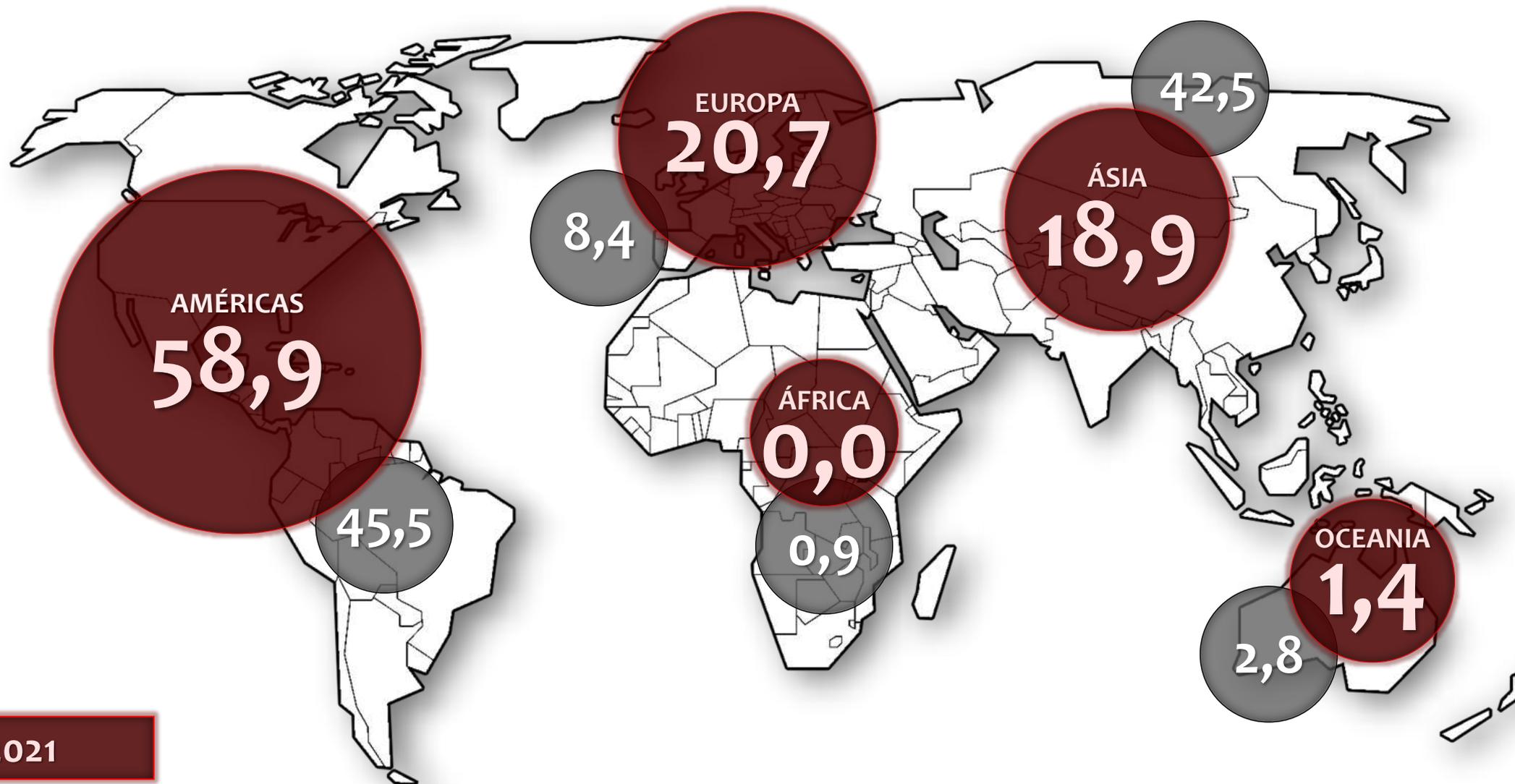


INCÊNDIOS
0,7 X 0,7

2021 = **101,8 X 200,1** = 2001 ... 2020

PERDAS ECONÔMICAS

PARTICIPAÇÃO NO TOTAL GERAL DE PERDAS ECONÔMICAS¹, POR CONTINENTE, EM 2021



2021

2001 ... 2020

PERDAS ECONÔMICAS¹ POR TIPO DE DESASTRE: 2021 X 2001 ... 2020²

SECAS
12,1 X 6,7



TERREMOTOS
11,3 X 35,4



TEMPERATURAS
EXTREMAS
5,6 X 3,1



INUNDAÇÕES
74,4 X 34,1



DESLIZAMENTOS
0,5 X 0,3



MOVIMENTOS DE
MASSA (SECOS)
0,0 X 0,0



TEMPESTADES
137,7 X 77,0



ATIVIDADES
VULCÂNICAS
1,3 X 0,1

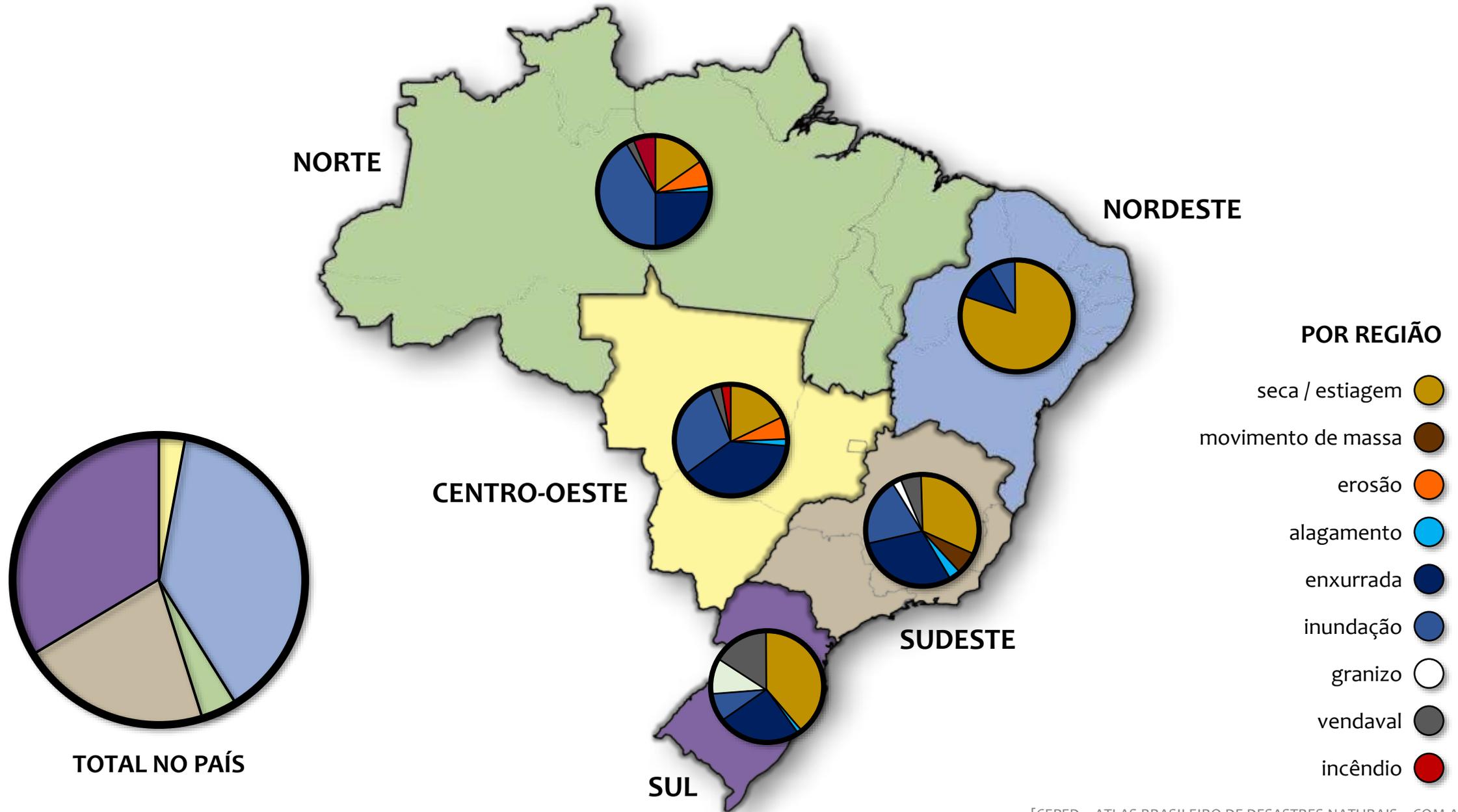


INCÊNDIOS
9,2 X 5,0

2021 = **252,1 X 161,7** = 2001 ... 2020

E NO BRASIL ?

BRASIL: DISTRIBUIÇÃO DE DESASTRES NATURAIS, POR REGIÃO: 1991 A 2012



TEMPOS DE ATENÇÃO

DO RISCO À REALIDADE



UM ABRIGO, DOIS DESAFIOS

para a vítima de um desastre natural, é preciso proporcionar ...



proteção



confiança



identidade



dignidade



bem-estar

e para as diretrizes arquitetônico-projetuais, programáticas e construtivas, deve-se equacionar ...



mobilidade



adaptabilidade



recursos



sistema
construtivo



conforto
ambiental



interação
social



adequação
cultural

ABRIGOS PÓS-ACIDENTES NATURAIS: TÉCNICAS CONSTRUTIVAS

P O R E N C A I X E S

tentative
designnobis
[Turquia, 2015]



[ARCHDAILY, 2022]



edificios religiosos “pop-up”

Yale School of Architecture
[EUA, 2016]



ASSEMBLY

Instructions for assembly and operation of the temporary chapel structure.

01 LAYING OUT THE FLOOR

02 RAISING THE GABLE

03 ERECTING THE FRAME

04 APPLYING THE CLADDING

05 USING THE PEWS

06 ENJOYING COMPLETION!

COMPONENTS

Complete inventory of package contents

#	PRT	QTY	DES
01	[Image]	14	Instruction for Assembly and Operation of the Temporary Floor of Chapel
02	[Image]	20	Instruction for Assembly and Operation of the Temporary Floor of Chapel
03	[Image]	2	Instruction for Assembly and Operation of the Temporary Floor of Chapel
04	[Image]	2	Instruction for Assembly and Operation of the Temporary Floor of Chapel
05	[Image]	20	Instruction for Assembly and Operation of the Temporary Floor of Chapel
06	[Image]	7	Instruction for Assembly and Operation of the Temporary Floor of Chapel
07	[Image]	2	Instruction for Assembly and Operation of the Temporary Floor of Chapel
08	[Image]	2	Instruction for Assembly and Operation of the Temporary Floor of Chapel
09	[Image]	5	Instruction for Assembly and Operation of the Temporary Floor of Chapel
10	[Image]	14	Instruction for Assembly and Operation of the Temporary Floor of Chapel
11	[Image]	14	Instruction for Assembly and Operation of the Temporary Floor of Chapel
12	[Image]	7	Instruction for Assembly and Operation of the Temporary Floor of Chapel
13	[Image]	20	Instruction for Assembly and Operation of the Temporary Floor of Chapel
14	[Image]	224	Instruction for Assembly and Operation of the Temporary Floor of Chapel

[ARCHDAILY, 2022]



ASSEMBLY

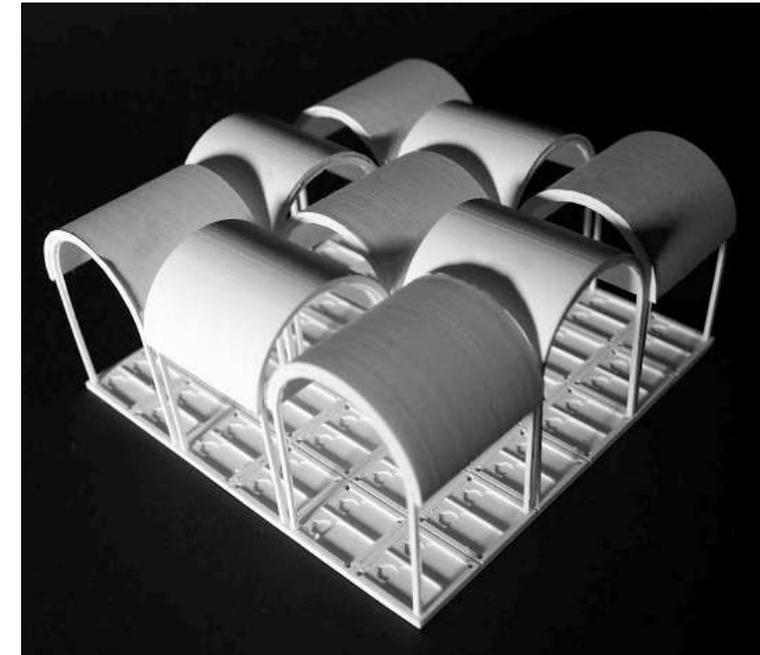
Instructions for assembly and operation of the temporary mosque structure.

01 LAYING OUT THE FLOOR

COMPONENTS

Complete inventory of package contents

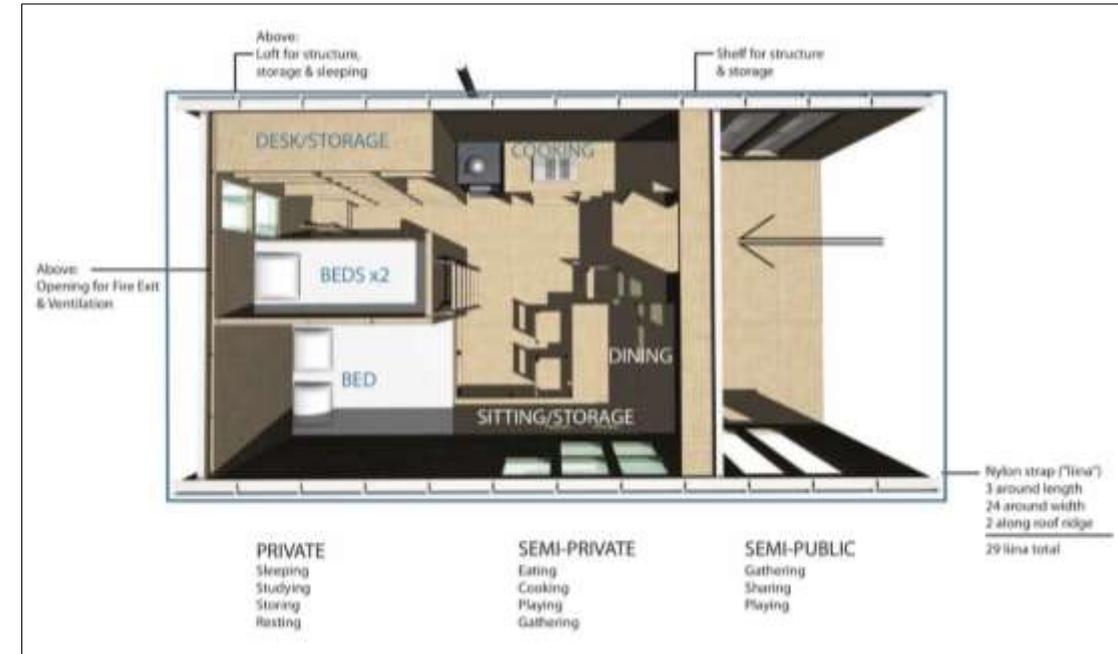
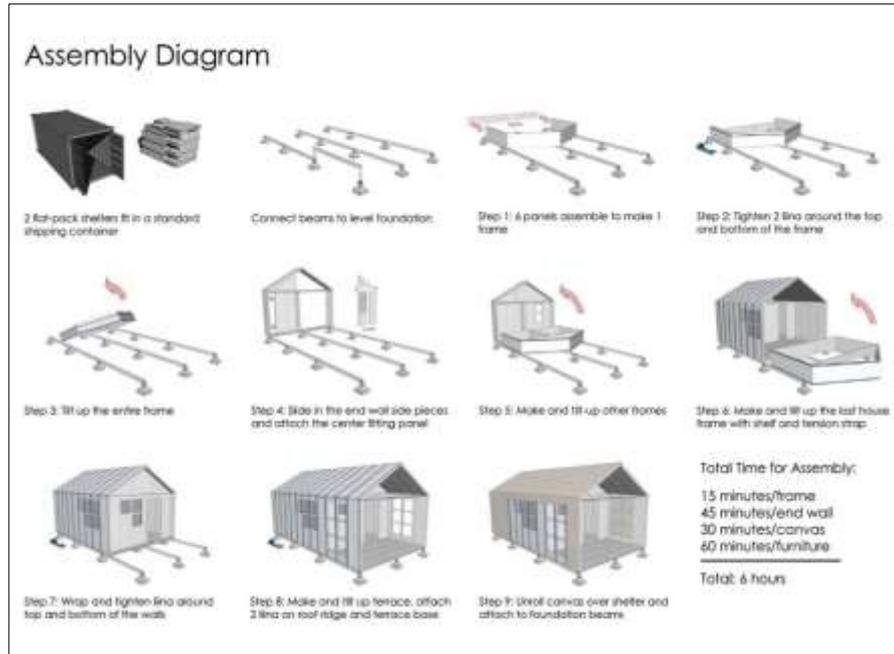
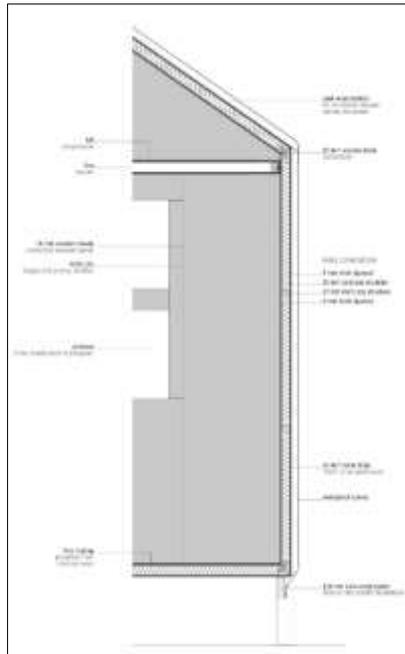
#	PRT	QTY	DES
01	[Image]	1	Instruction for Assembly and Operation of the Temporary Floor of Mosque
02	[Image]	30	Instruction for Assembly and Operation of the Temporary Floor of Mosque
03	[Image]	30	Instruction for Assembly and Operation of the Temporary Floor of Mosque
04	[Image]	8	Instruction for Assembly and Operation of the Temporary Floor of Mosque
05	[Image]	8	Instruction for Assembly and Operation of the Temporary Floor of Mosque
06	[Image]	30	Instruction for Assembly and Operation of the Temporary Floor of Mosque
07	[Image]	18	Instruction for Assembly and Operation of the Temporary Floor of Mosque
08	[Image]	30	Instruction for Assembly and Operation of the Temporary Floor of Mosque
09	[Image]	2	Instruction for Assembly and Operation of the Temporary Floor of Mosque
10	[Image]	4	Instruction for Assembly and Operation of the Temporary Floor of Mosque
11	[Image]	8	Instruction for Assembly and Operation of the Temporary Floor of Mosque
12	[Image]	5	Instruction for Assembly and Operation of the Temporary Floor of Mosque



abrigo de transição liina

Aalto University Wood Program
[Finlândia, 2011]

[ARCHDAILY, 2022]

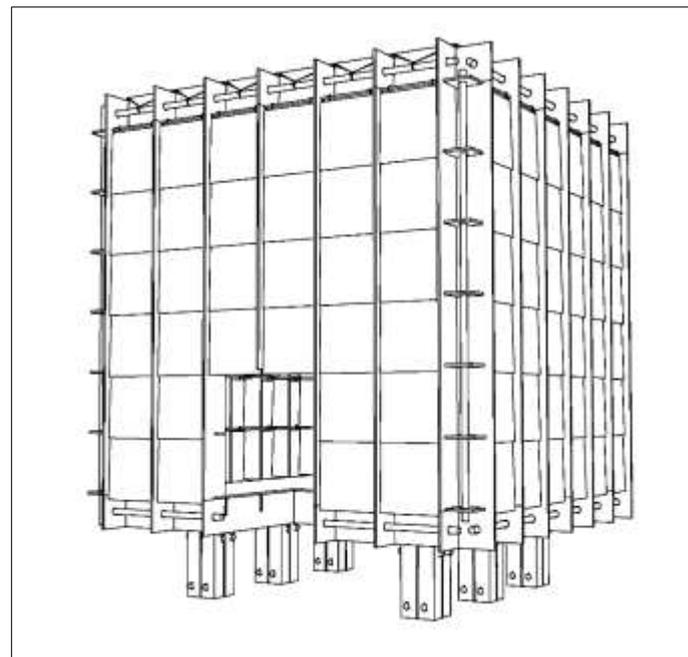
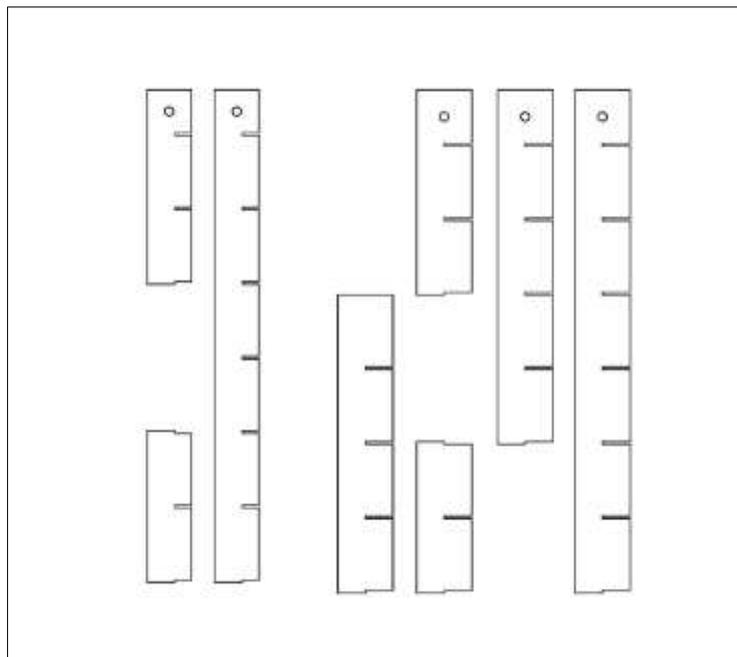


abrigo de emergência

Nic Gonsalves + Nic Martoo

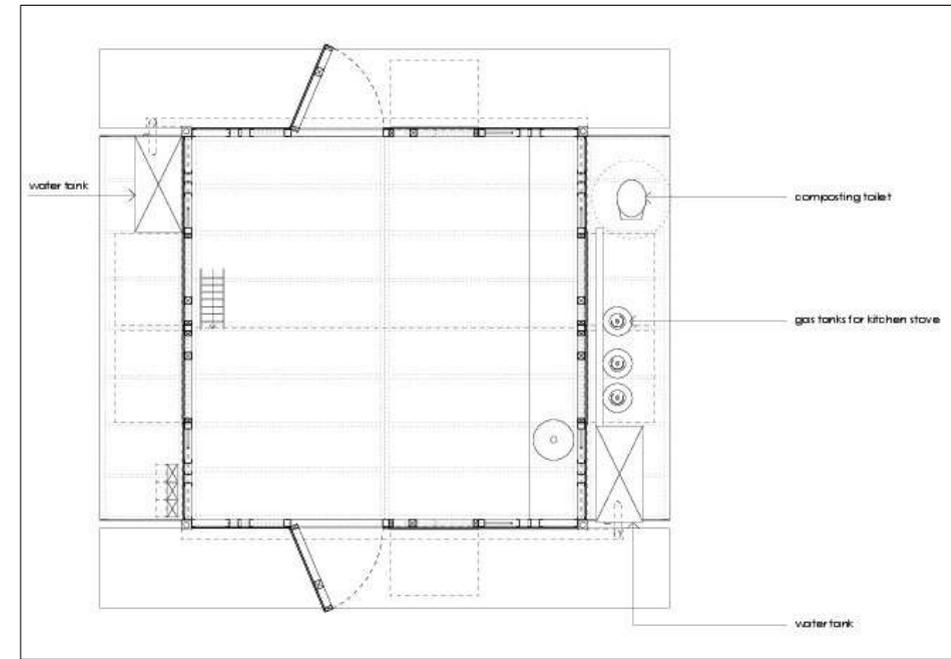
[Austrália, 2012]

[ARCHDAILY, 2022]

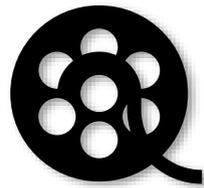


abrigo de emergência

Carter Williamson Architects
[Austrália, 2012]



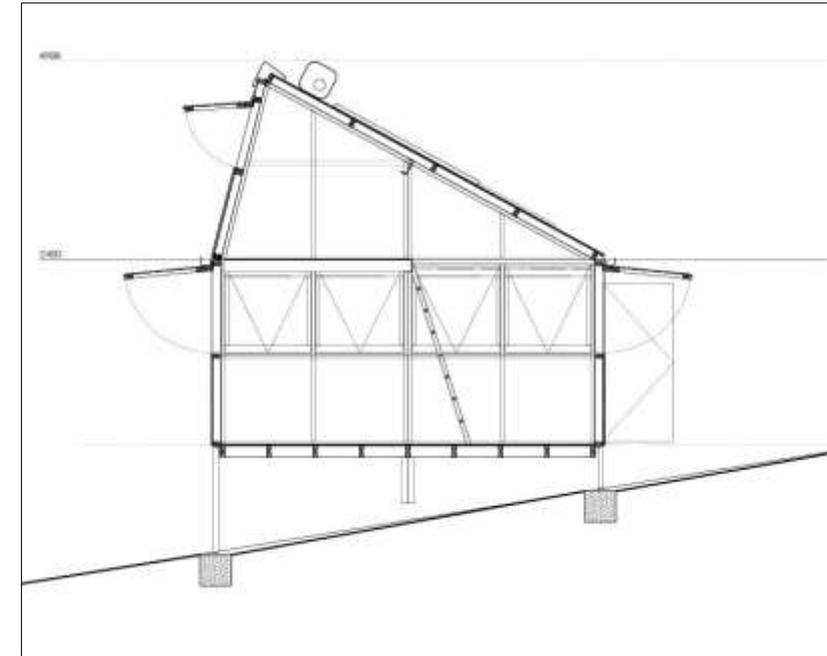
[ARCHDAILY, 2022]



shelter

disponível em:

<https://www.youtube.com/watch?v=EygoF9GW7Uo>



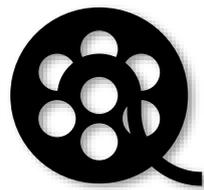
better shelter

Fundação Ikea

[Suécia, 2013]



[METALOCUS (2022); ARCHDAILY (2022)]



better shelter assembly

disponível em:

<https://www.youtube.com/watch?v=tsydH3wSwBE>



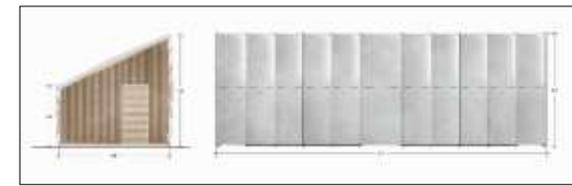
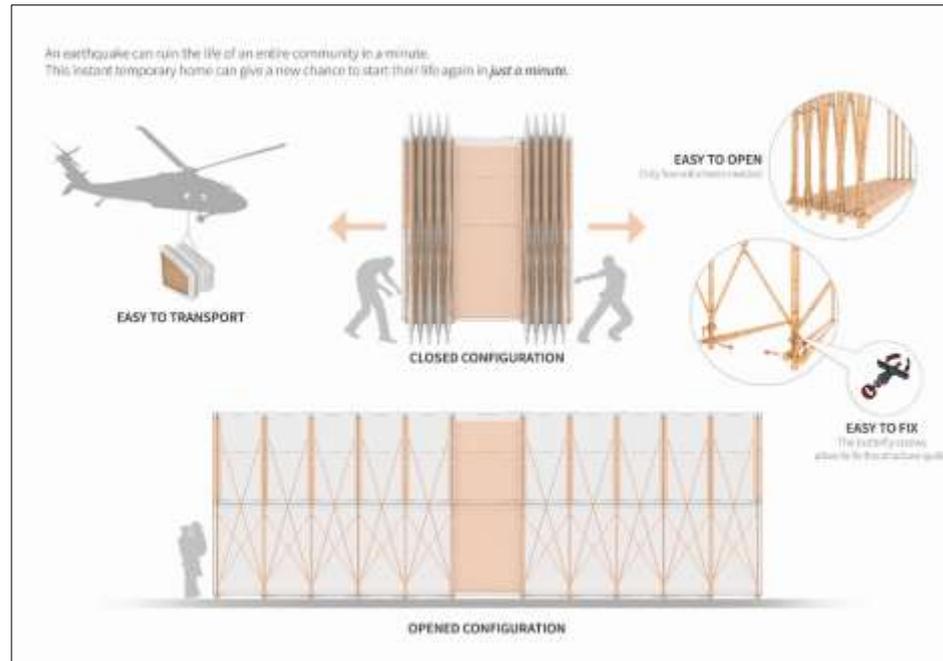
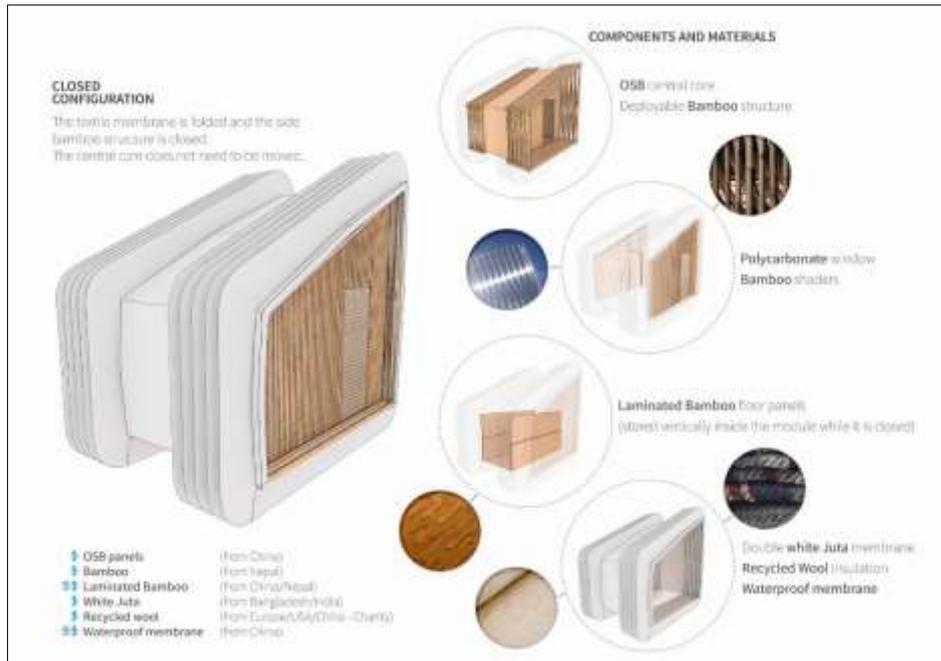
RETRÁTEIS / EXPANSÍVEIS

just a minute

Barberio Colella ARC
[Nepal, 2015]



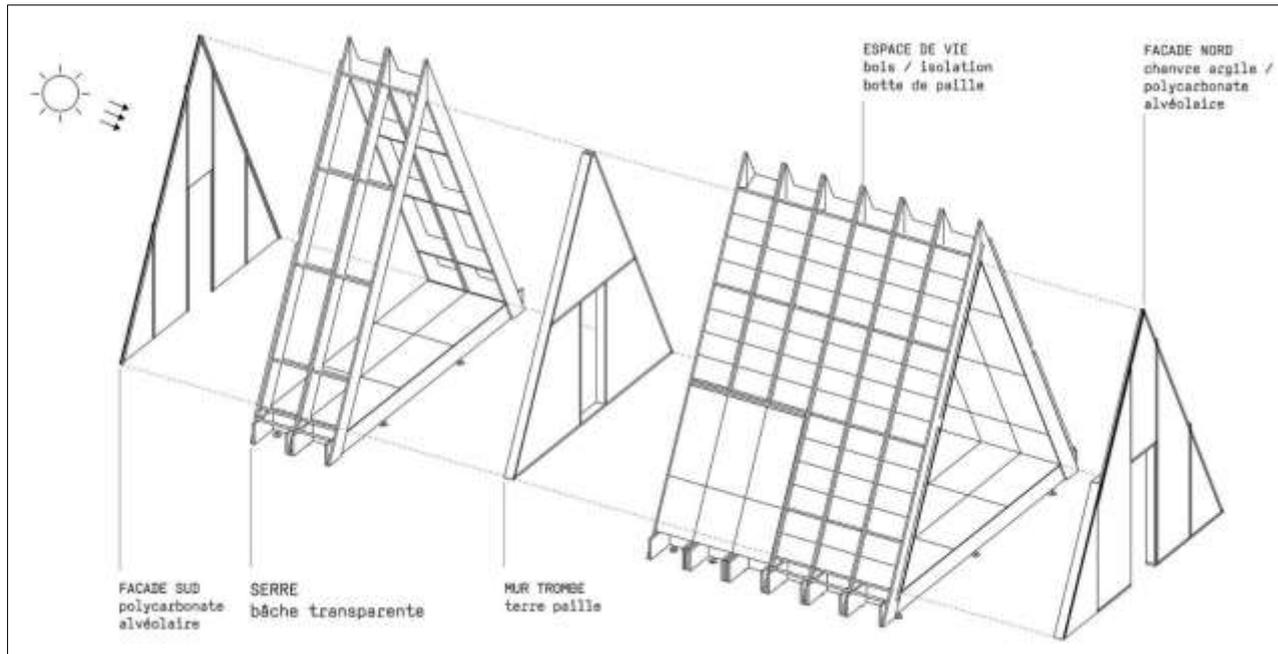
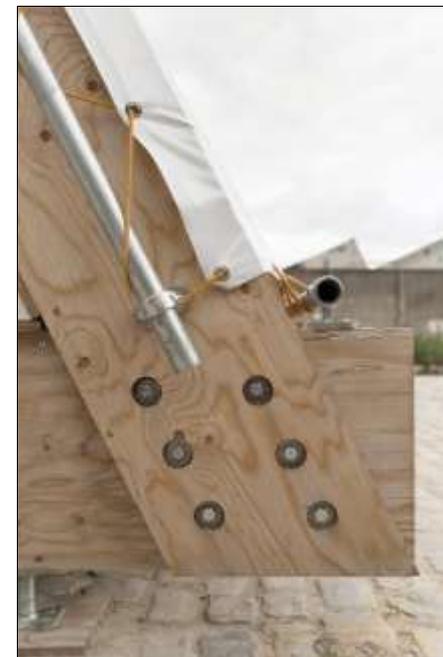
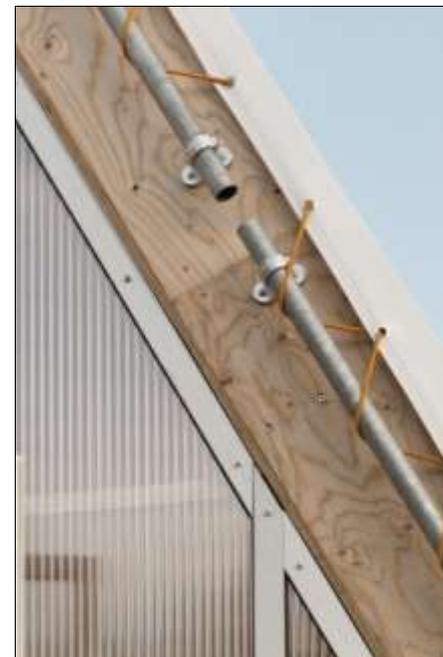
[ARCHDAILY, 2022]



área de repouso

Atelier Craft
[França, 2021]

[ARCHDAILY, 2022]



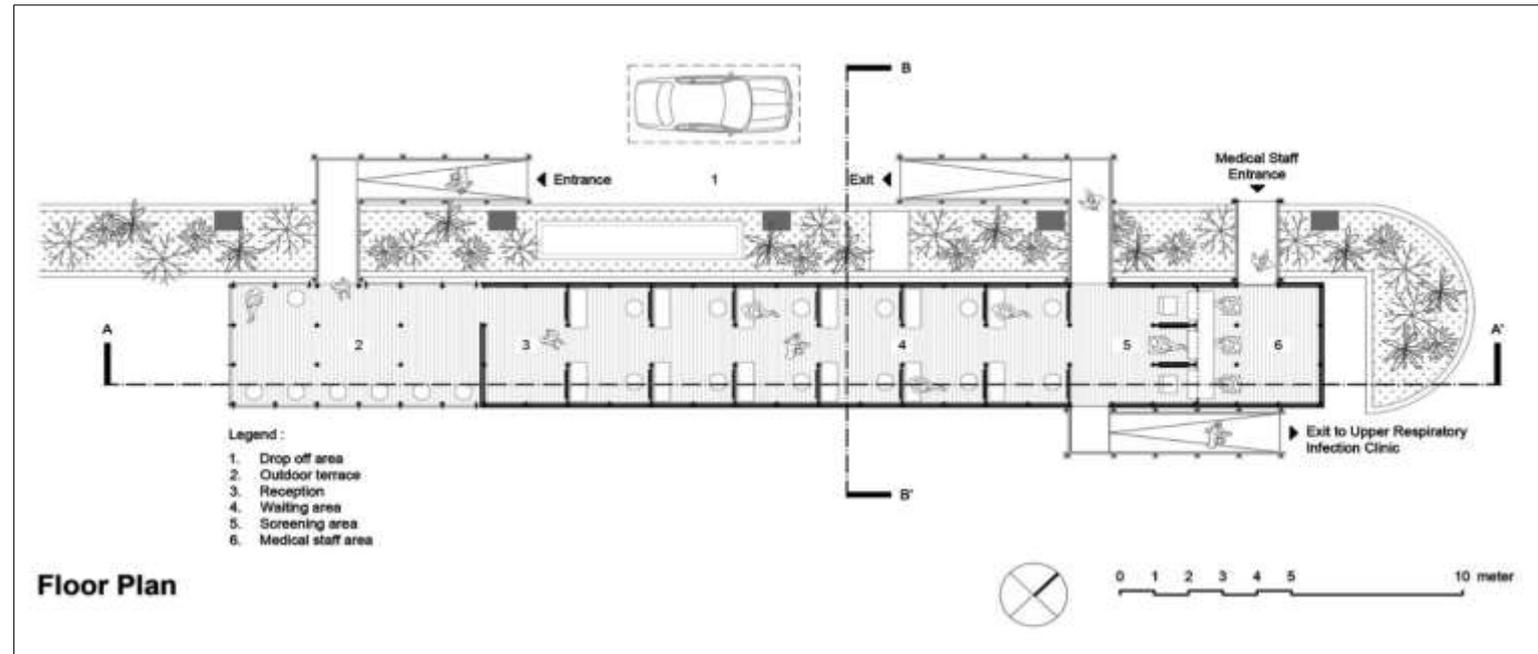
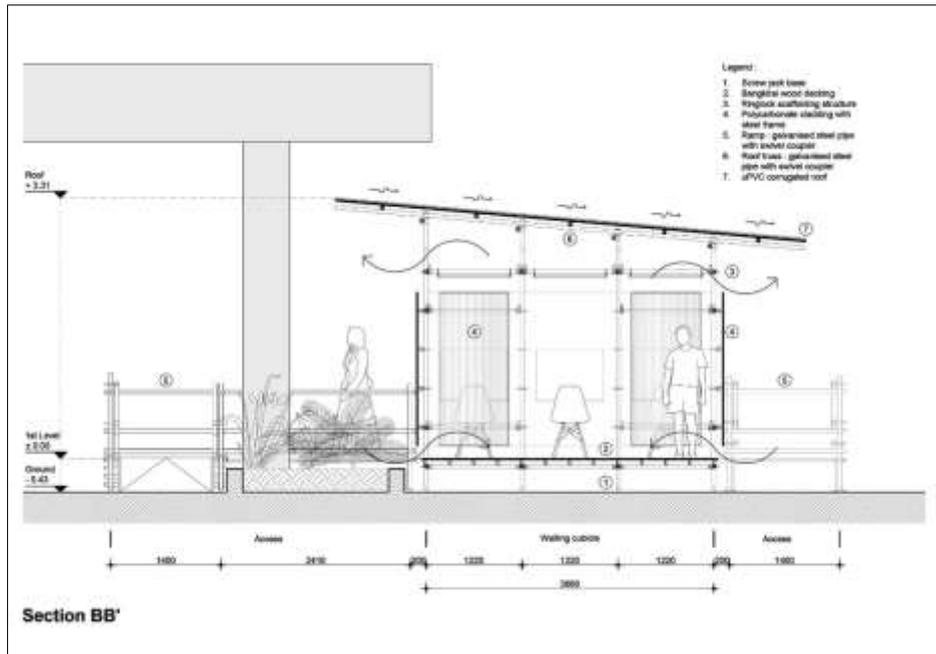
instalação para triagens do hospital st. carolus

AT-LARS

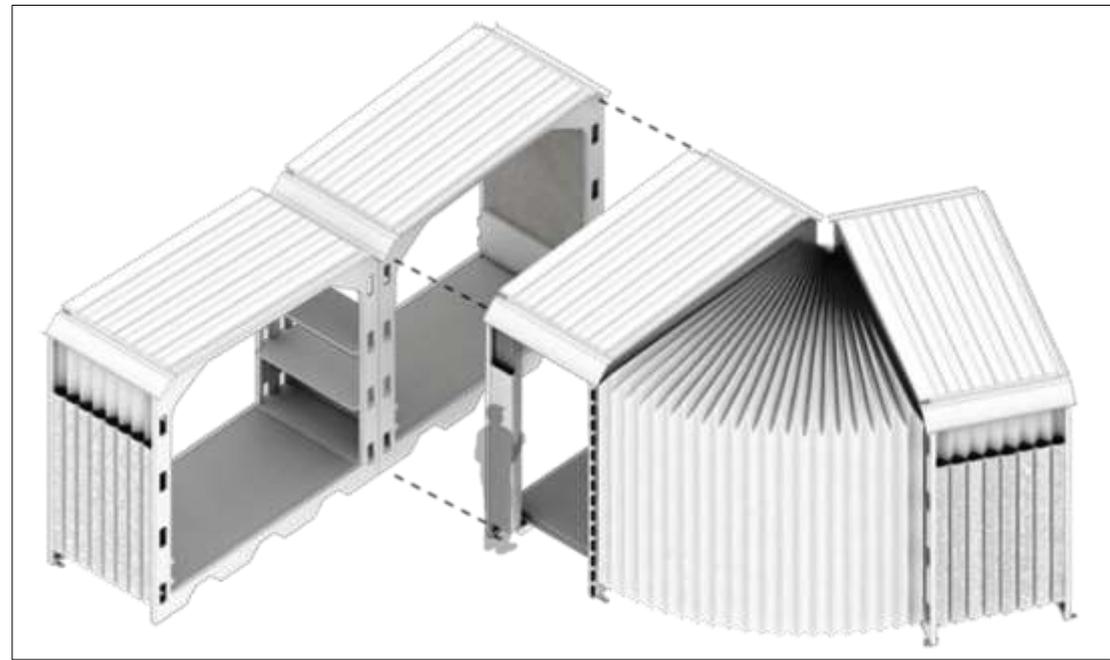
[Indonésia, 2020]



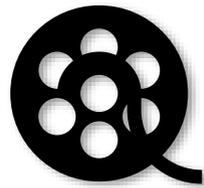
[ARCHDAILY, 2022]



abrigo suri
Suricata Systems
[Espanha, 2015]



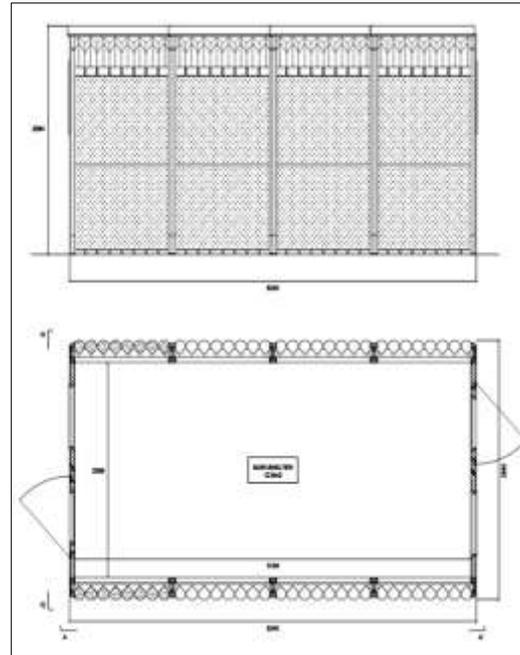
[ARCHDAILY, 2022]



suri shelter fabric facade assembly video

disponível em:

<https://www.youtube.com/watch?v=qnlTG9DQDvo>

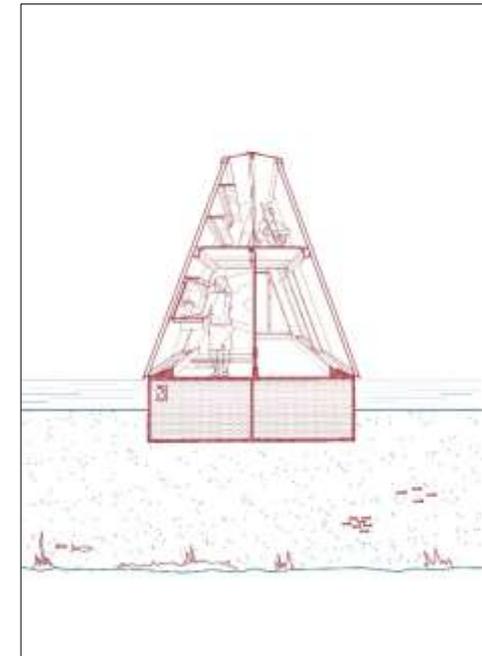
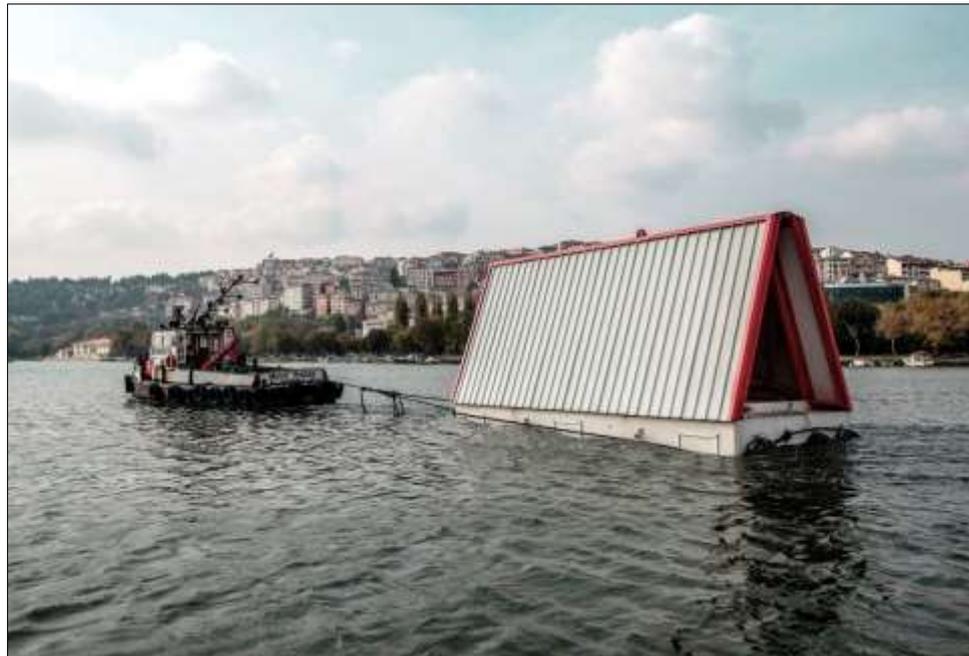
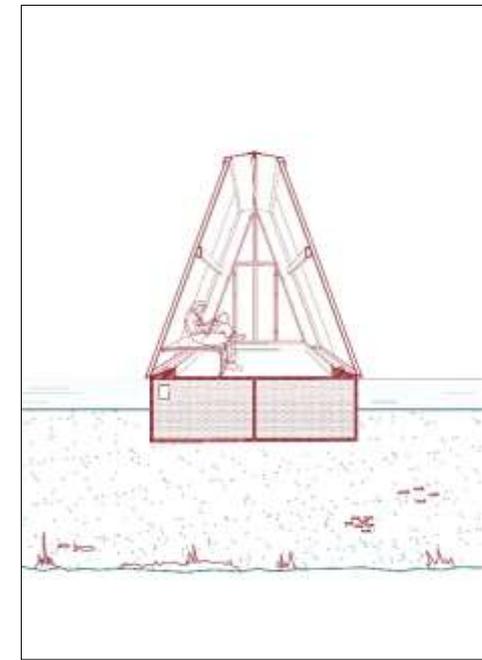
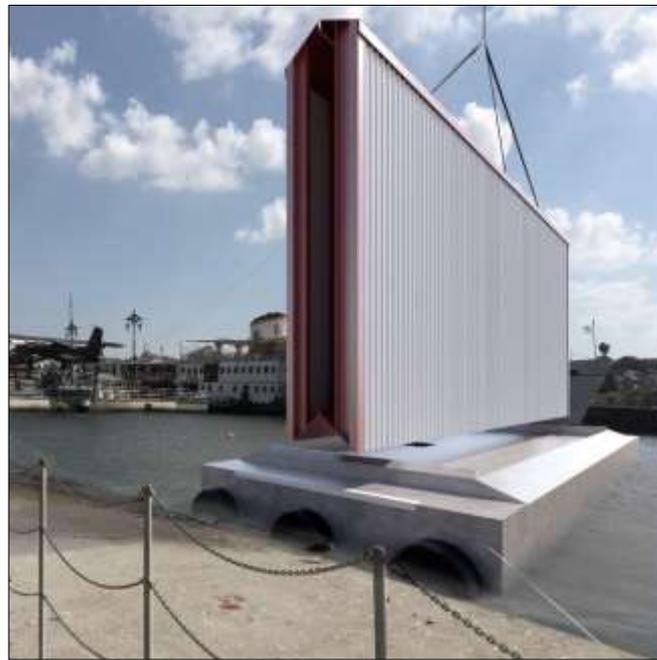


FLUTUANTES

fold & float

SO?
[Turquia, 2019]

[ARCHDAILY, 2022]

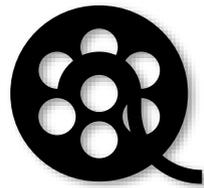


survival capsule

Julian Sharpe + Scott Hill
[EUA, 2011]



[NEW ATLAS, 2022]



'survival capsule' for tsunami

disponível em:

<https://www.youtube.com/watch?v=k8Qzu8YY3ic>

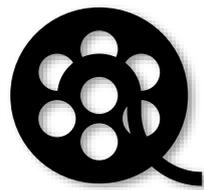


SAFE+ floating shelter

Tajima Motor Corporation
[Japão, 2015]



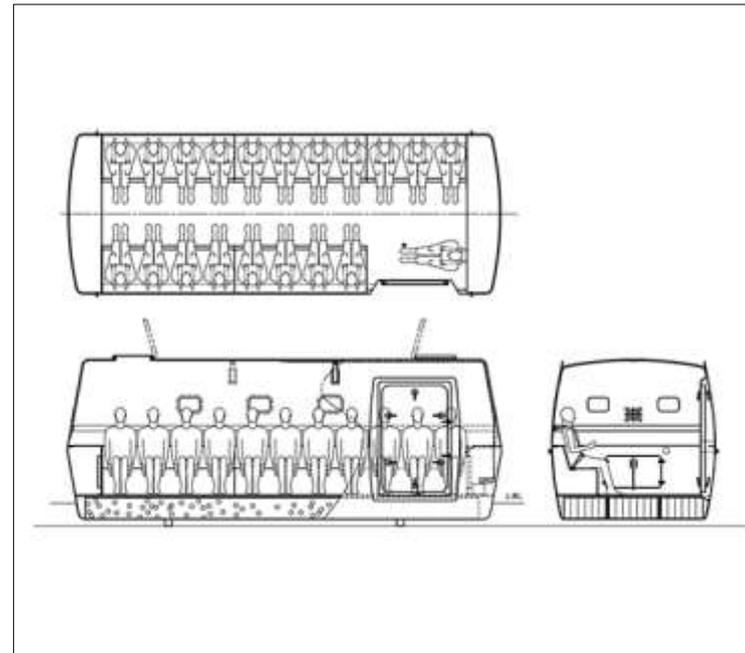
[TAJIMA, 2022]



tsunami floating shelter SAFE+ survival pod

disponível em:

<https://www.youtube.com/watch?v=HEcfGNNaHkE>

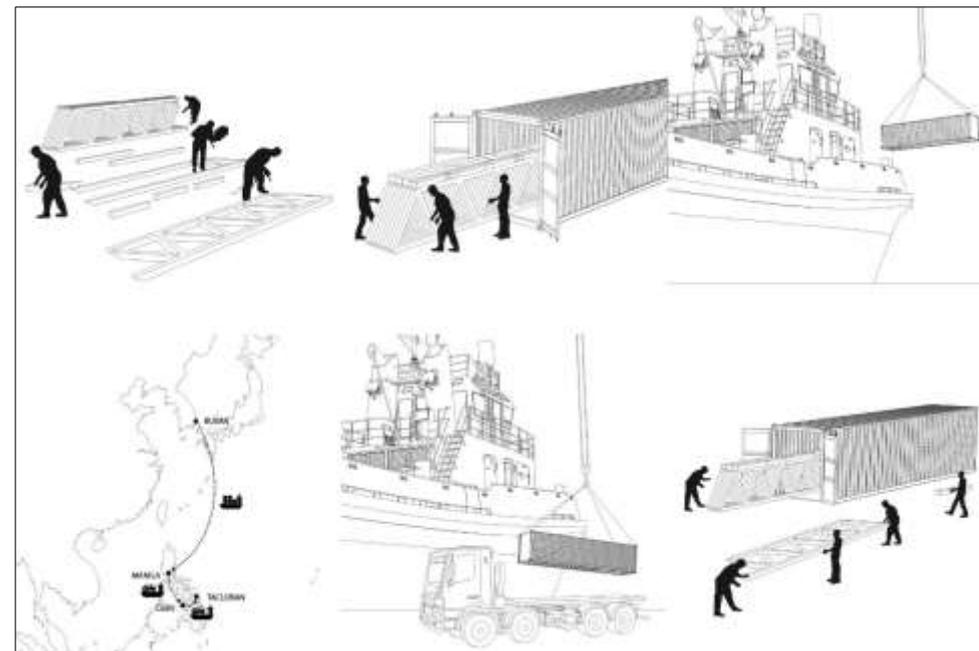


PRÉ-FABRICADOS EM AÇO

abrigo em resposta a desastres naturais

Urban Intensity Architects +
TAArchitects + Kyungsub Shin
[Filipinas, 2015]

[ARCHDAILY, 2022]

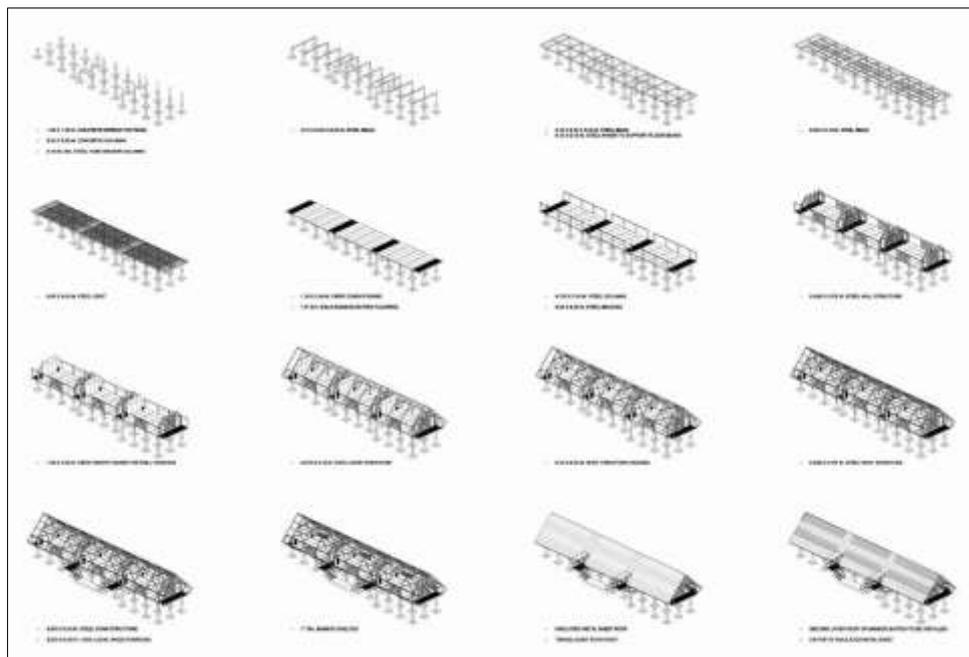


escola pós-desastre bann huay san yaw

Vin Varavarn Architects
[Tailândia, 2015]



[ARCHDAILY, 2022]

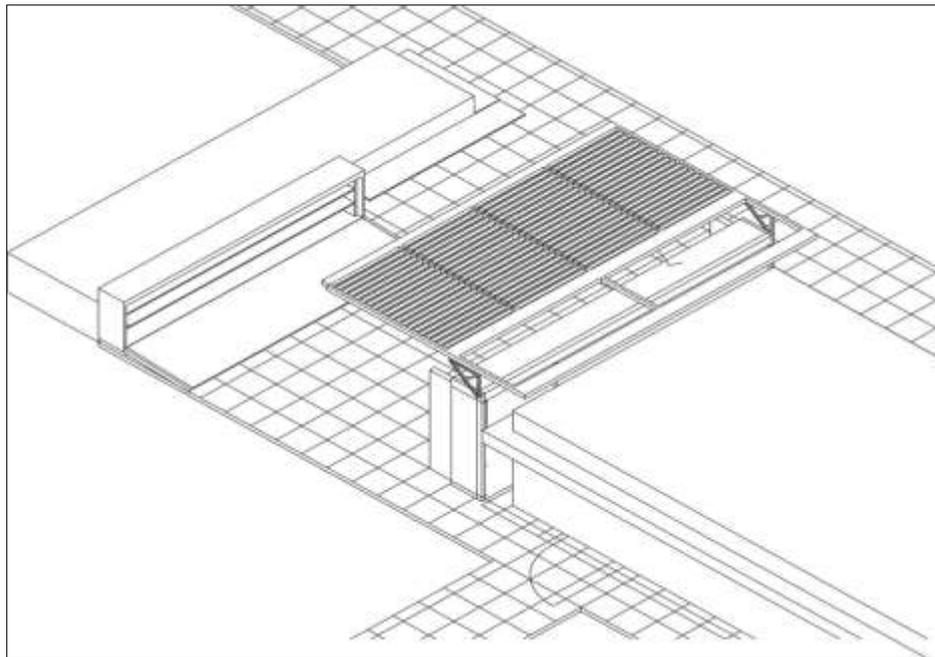
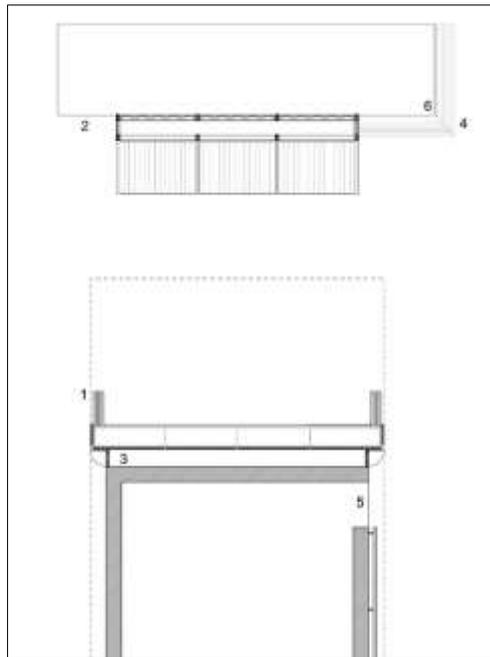


biblioteca no jardim

Yoav Meiri Architects

[Israel, 2010]

[ARCHDAILY, 2022]

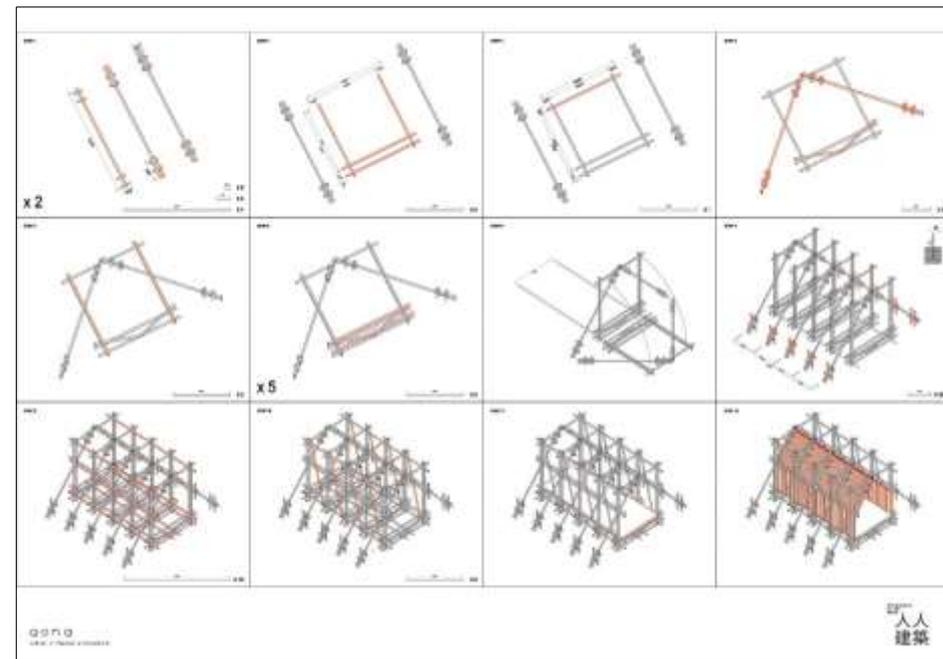
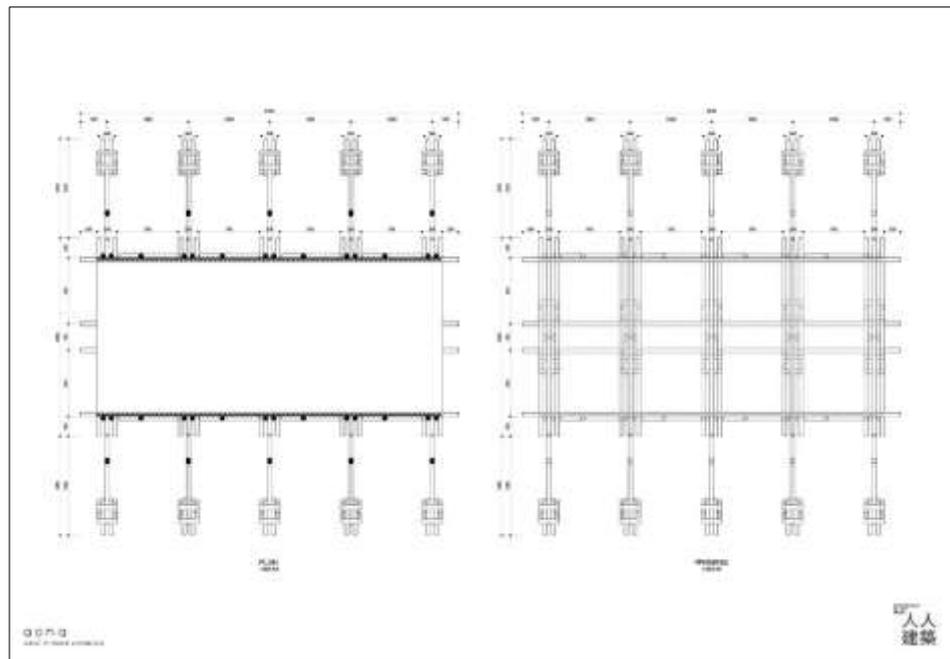
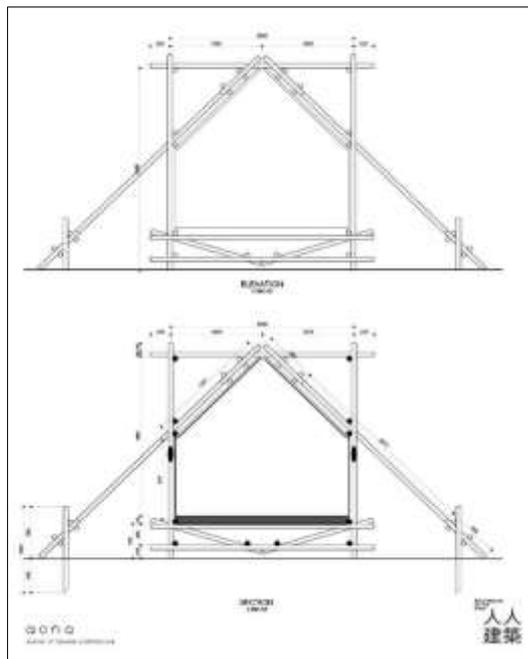


ESTRUTURAS EM MADEIRA E DERIVADOS

abrigo temporário no nepal

Charles Lai + Takehiko Suzuki
[Nepal, 2015]

[ARCHDAILY, 2022]

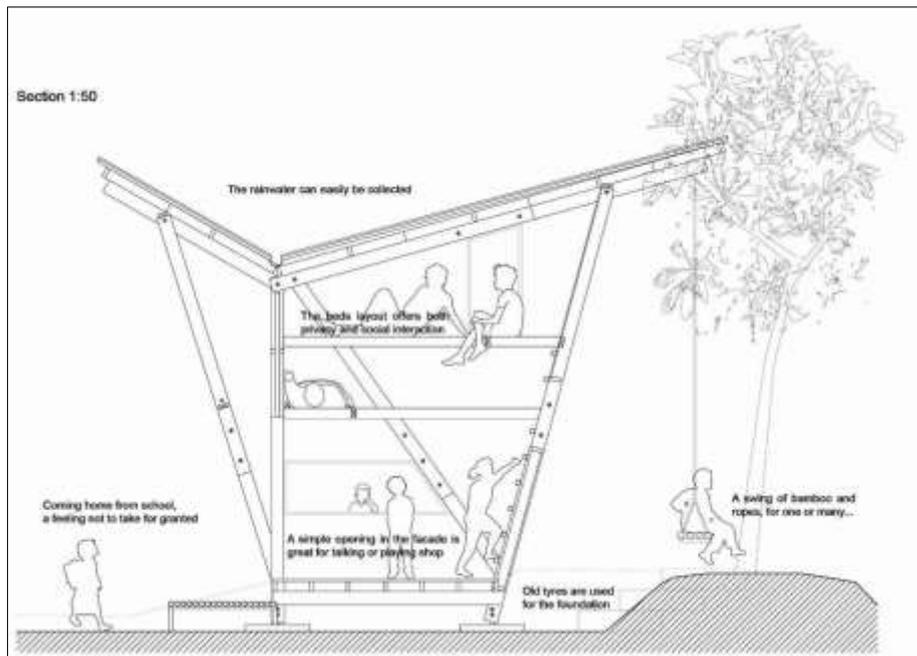


soe ker tie house

TYIN Tegnestue Architects
[Tailândia, 2009]



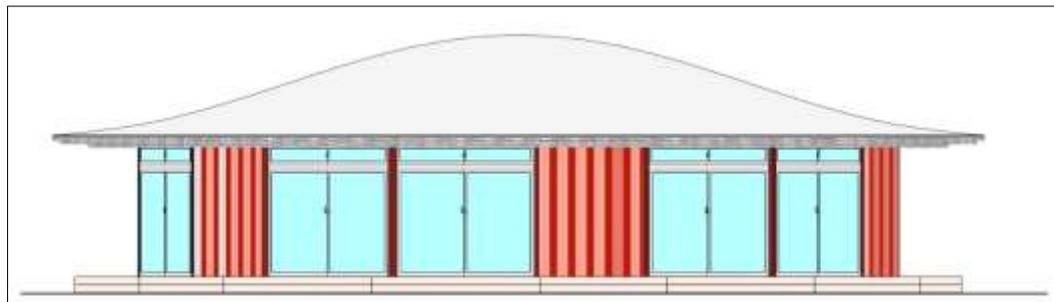
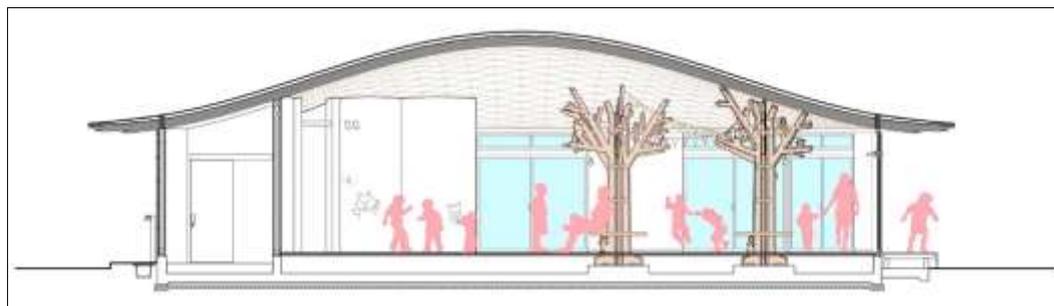
[ARCHITIZER, 2009]



casa-para-todos

Toyo Ito & Associates +
Klein Dytham Architecture
[Japão, 2015]

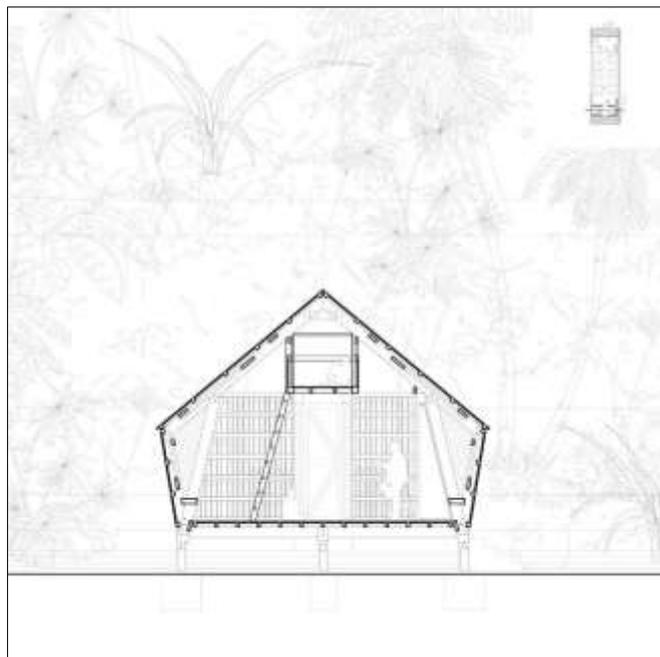
[ARCHDAILY, 2022]



escola ranwas
Caukin Studio
[Vanuatu, 2019]

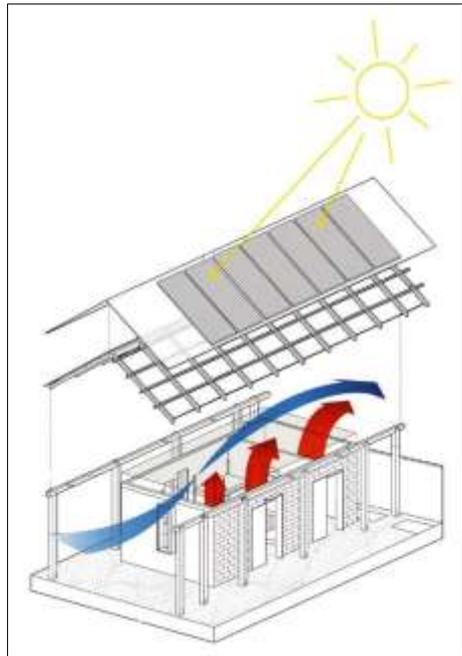


[ARCHDAILY, 2022]



ti kay là
Bonaventura di Modrone
[Haiti, 2015]

[ARCHDAILY, 2022]



EM PAPEL / PAPELÃO

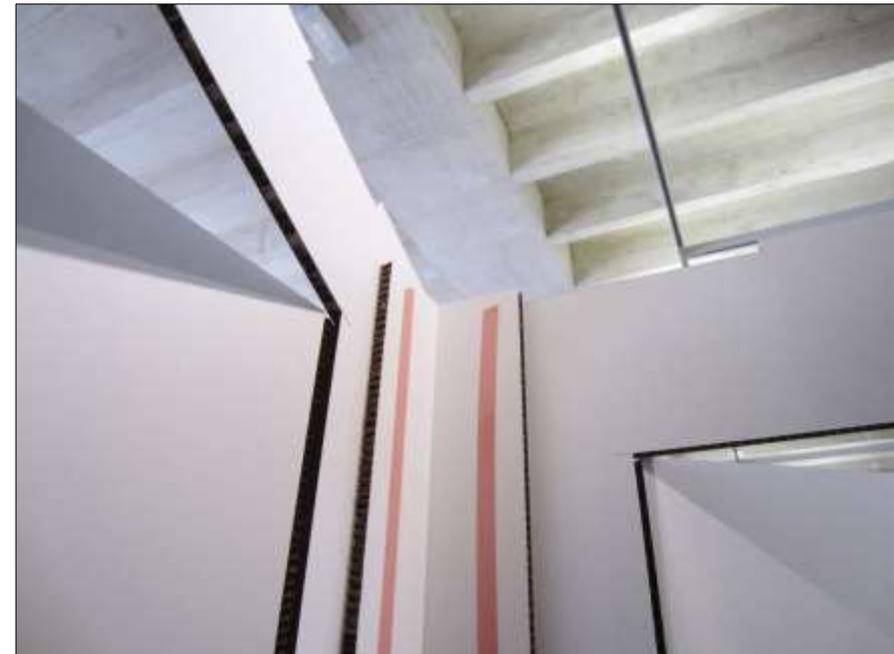
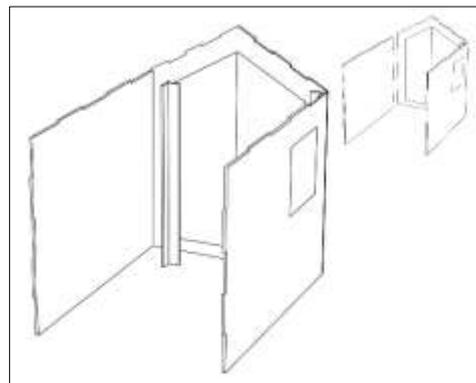
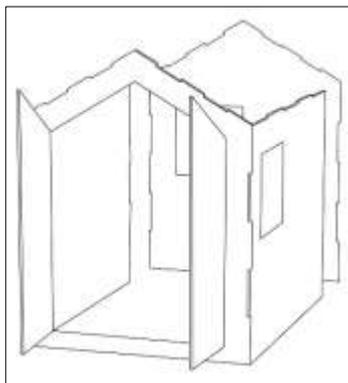
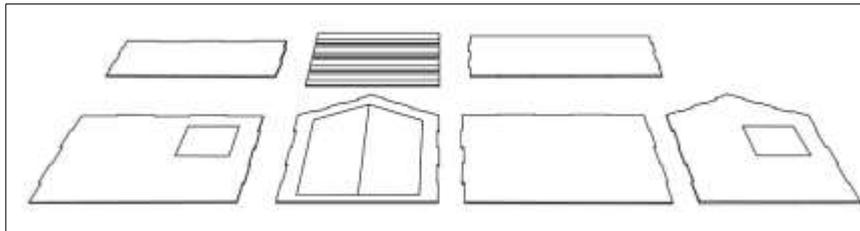
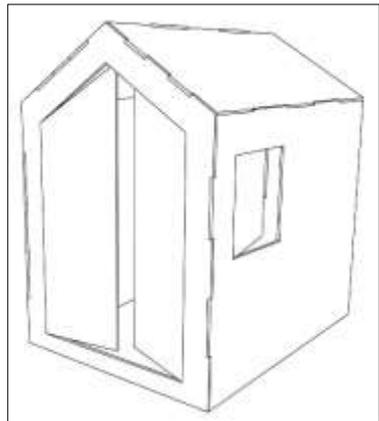
origami – casas de papel

Architecture Global Aid (AGA)

[Espanha, 2014]



[ARCHDAILY, 2022]



 = 7×7 =  $\times 3$

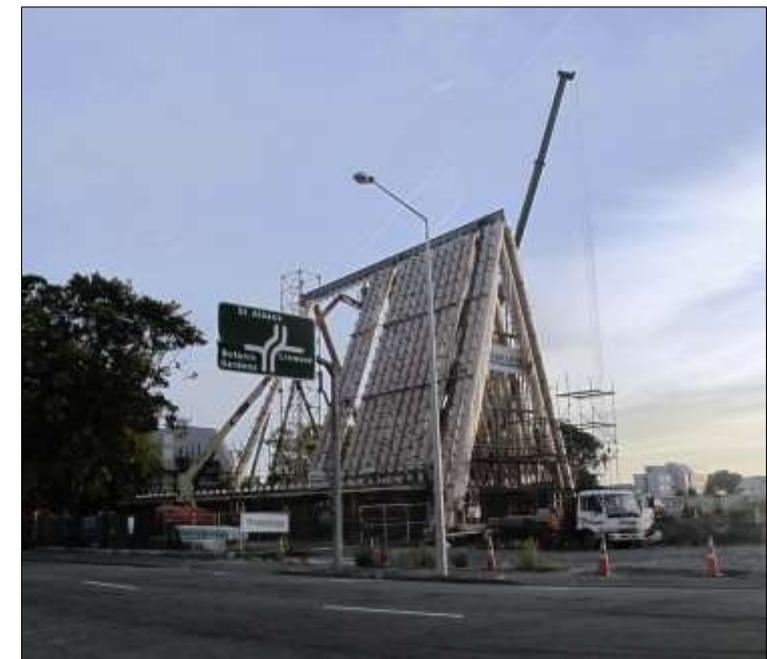
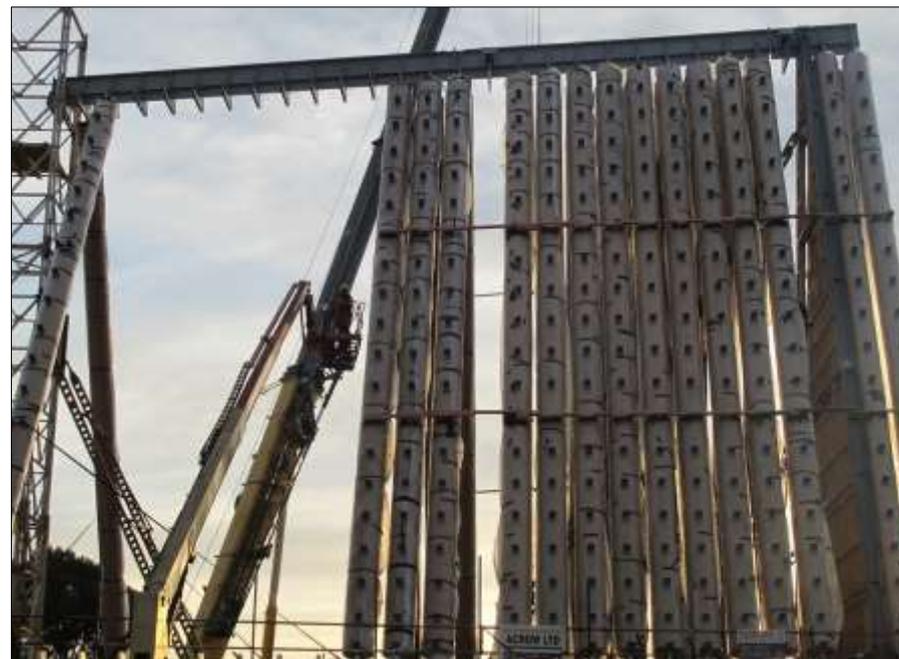
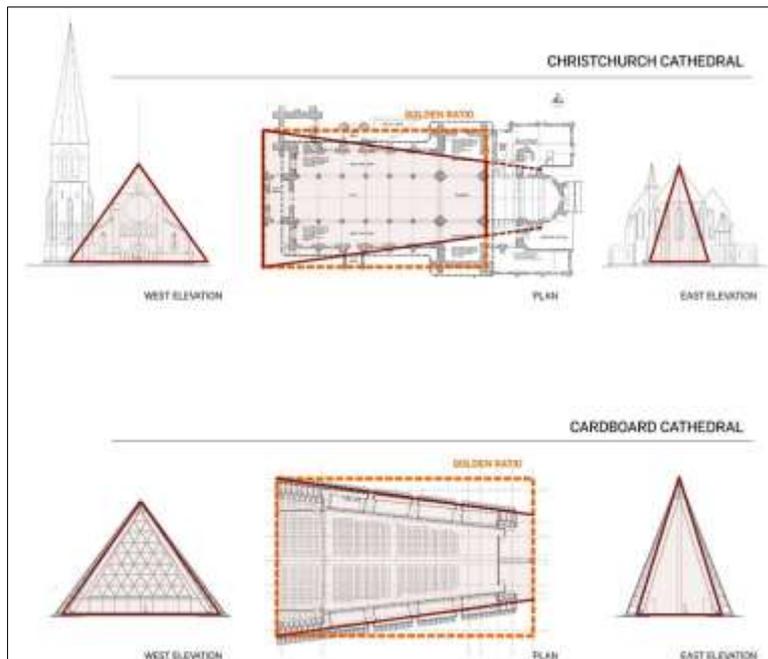
 $\approx 2,8\text{m}^3$

 $\approx 1,5\text{m}^2$

catedral transitória de papelão

Shigeru Ban Architects
[Nova Zelândia, 2013]

[ARCHDAILY, 2022]

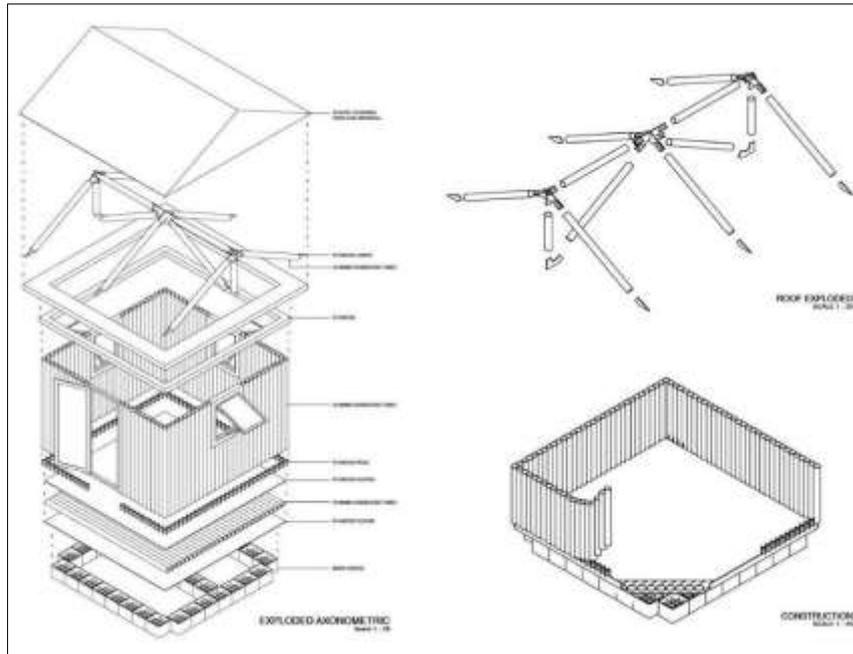


casas de papelão

Shigeru Ban Architects
[Japão, 1995]



[AFASIA (2022); ARCHDAILY (2022)]



**casas de bambu
e papelão**
Shigeru Ban Architects
[Equador, 2016]

[AFASIA (2022); ARCHDAILY (2022)]



divisórias em papel

Shigeru Ban Architects +
Voluntary Architects'
Network (VAN)
[Ucrânia, 2022]



[ARCHDAILY, 2022]

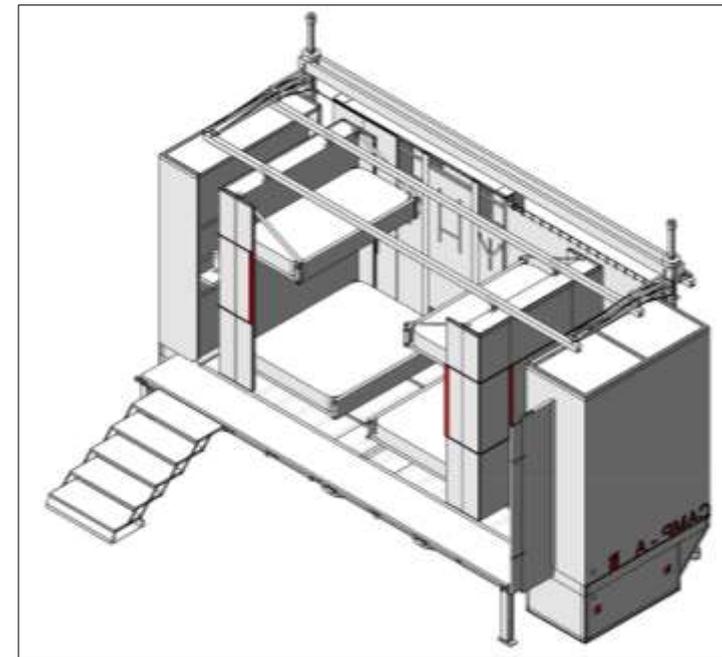
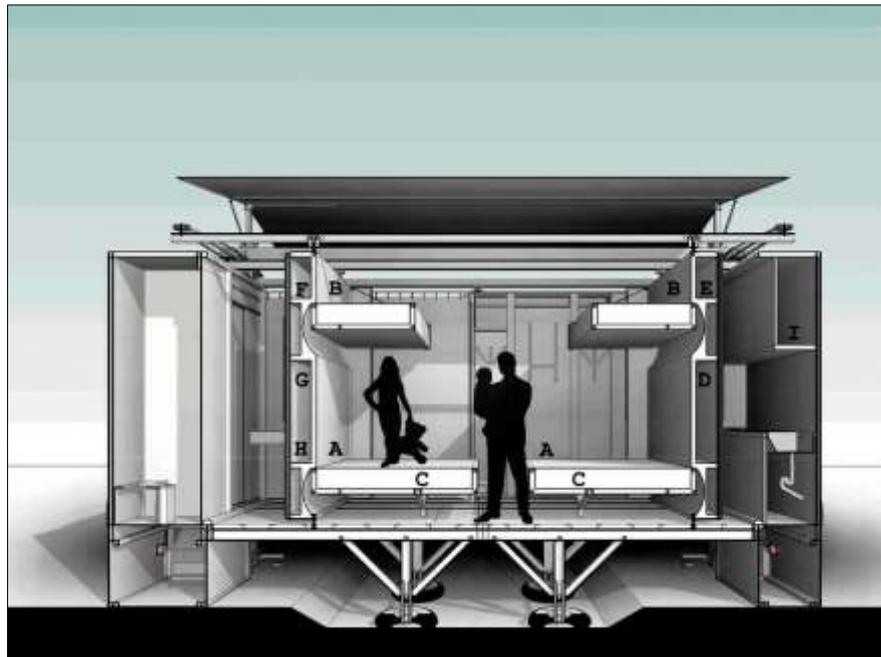
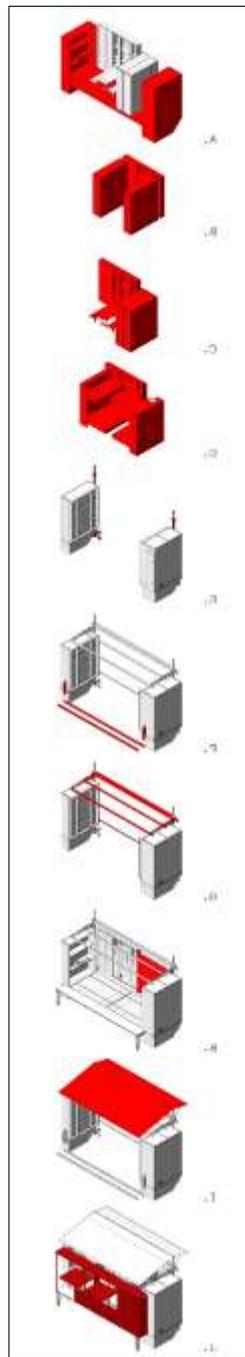
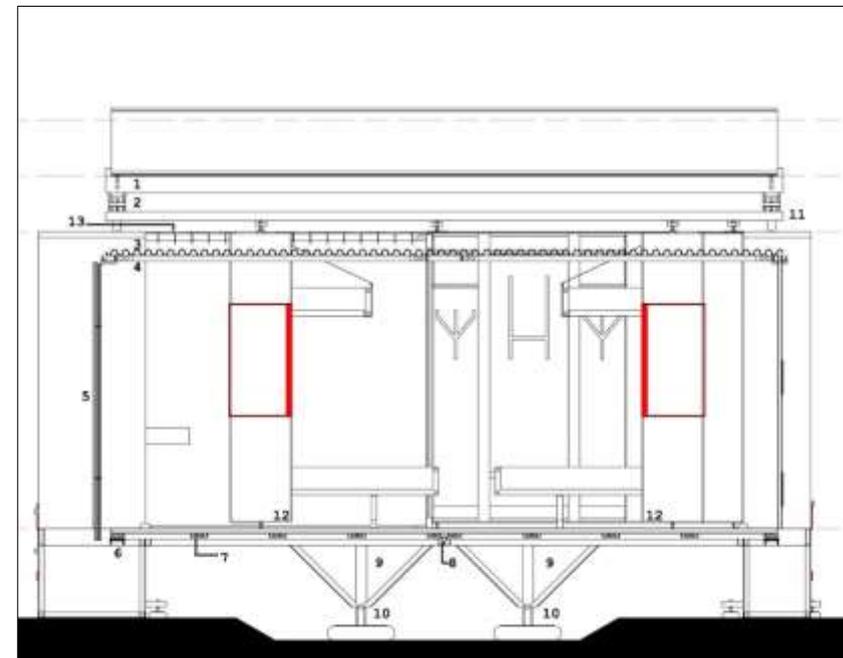
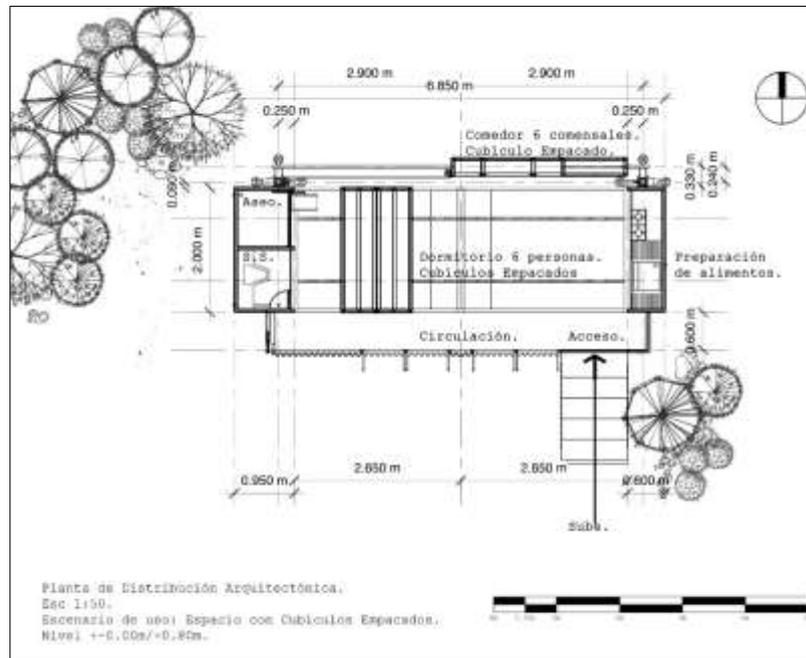


EM CÁPSULAS

cápsula habitacional

César Oreamuno

[Costa Rica, 2016]

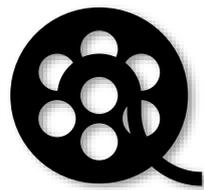


exo

Reaction Housing System
[EUA, 2011]



[ARCHDAILY, 2022]



reaction housing system overview

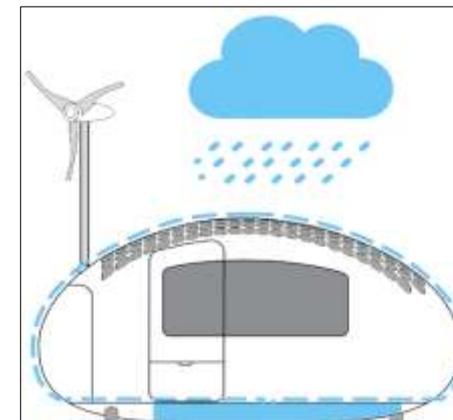
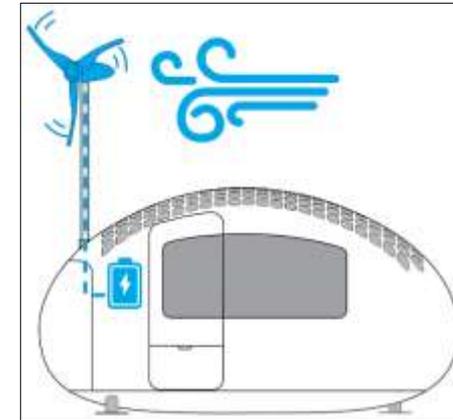
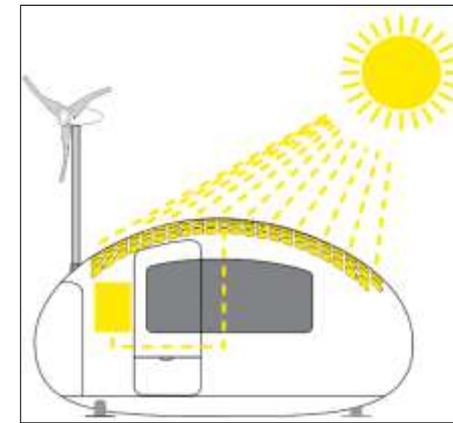
disponível em:

<https://www.youtube.com/watch?v=zdQwYEydo8c>

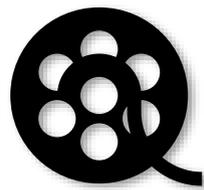


ecocapsule

Ecocapsule + Tomas Zacek
[Eslováquia, 2018]



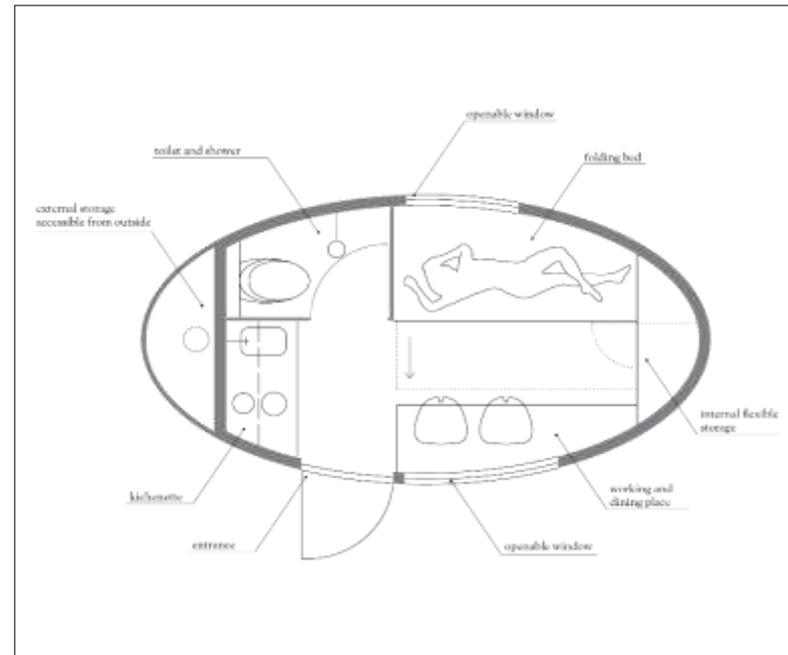
[ARCHDAILY, 2022]



ecocapsule: new era of sustainable living

disponível em:

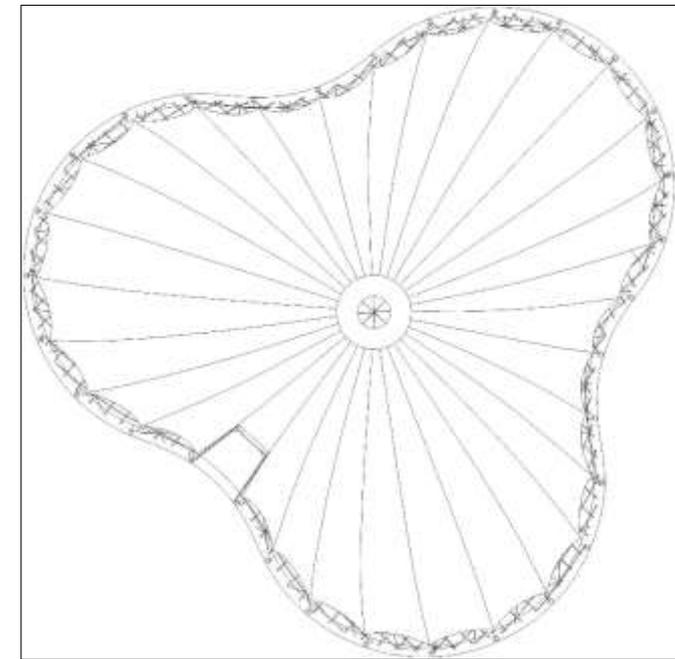
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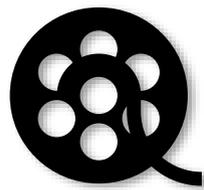
INFLÁVEIS

sheltair

Departamento de Design
Estrutural e Engenharia
(KET) da Universidade de
Artes de Berlim
[Alemanha, 2017]



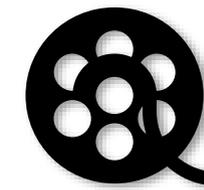
[ARCHDAILY, 2022]



sheltair – erection video

disponível em:

<https://www.youtube.com/watch?v=OKe14VFo3RM>



sheltair – wide angle

disponível em:

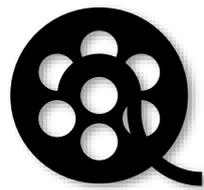
<https://www.youtube.com/watch?v=M1pBRpF6G-8>

tendas infláveis emergenciais para atendimento médico

Lanco Group
[Alemanha, 2020]



[LANCO (2022); INHABITAT (2022)]



lanco ARZ 15 H - setup

disponível em:

<https://www.youtube.com/watch?v=29gLJ2zaXbA>



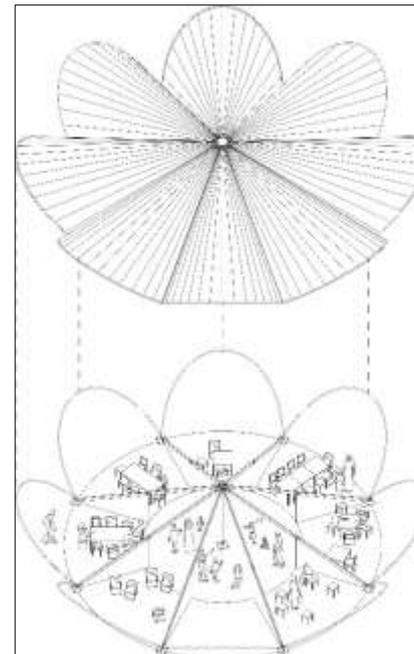
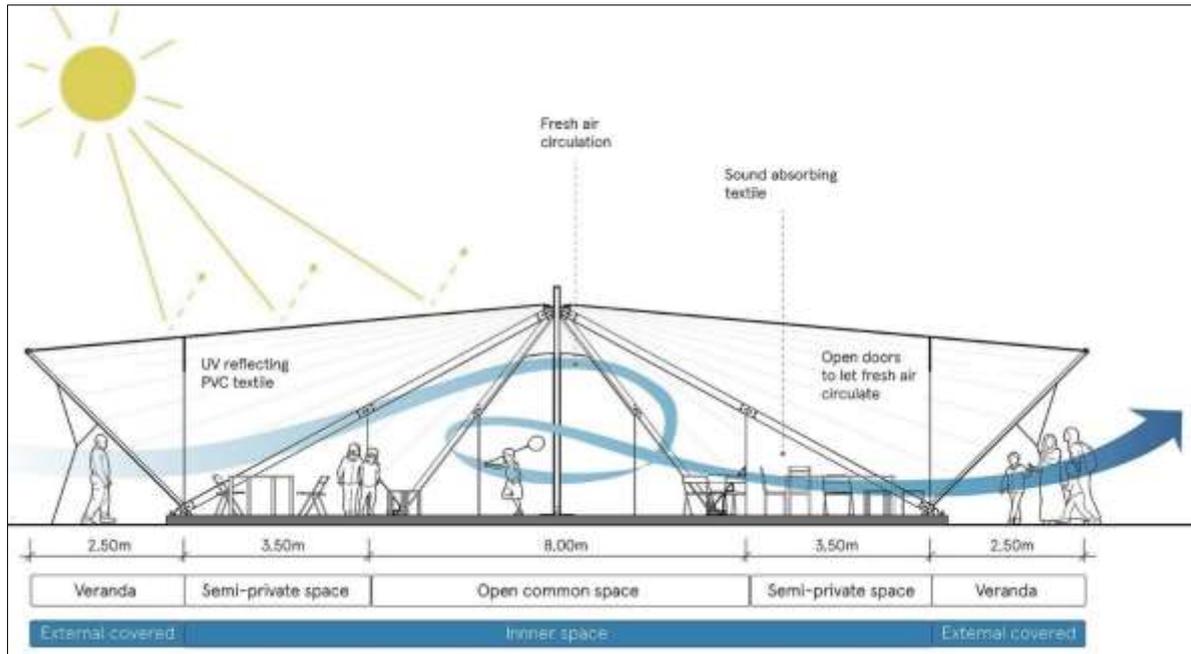
MEMBRANAS

tenda maidan

Bonaventura Visconti di Modrone
+ Leo Bettini Oberkalmsteiner
[Grécia, 2017]



[ARCHDAILY, 2022]

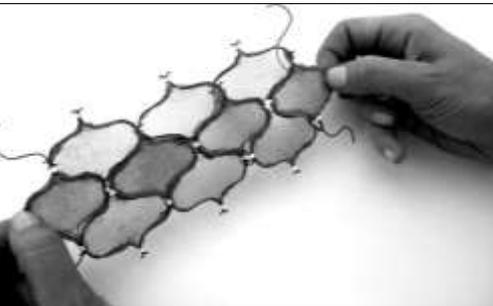
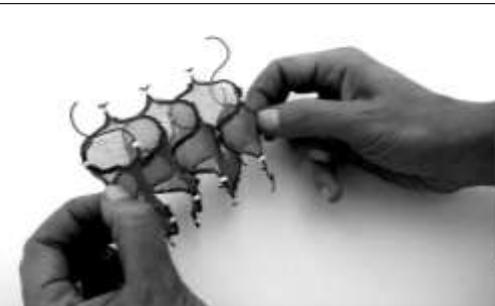
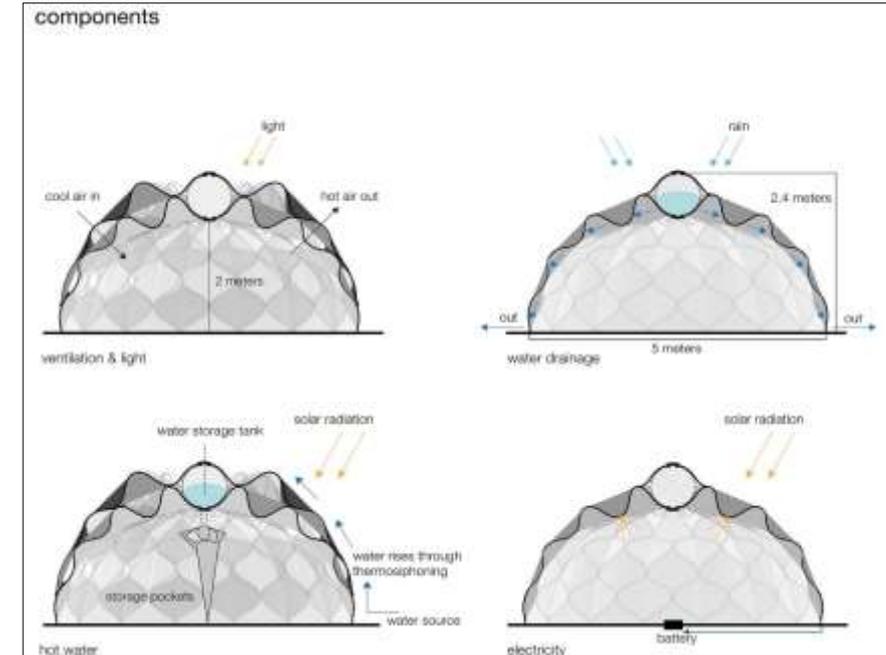
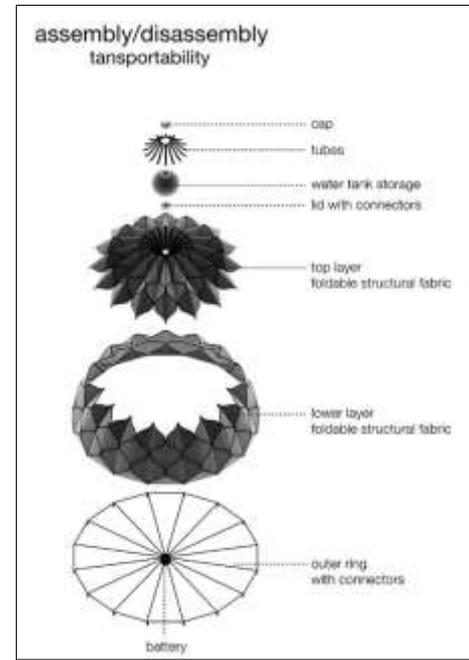


tecendo um lar

Abeer Seikaly

[Jordânia, 2013]

[ABEER SEIKALY (2022); ARCHDAILY (2022)]



COMO CITAR ESTE MATERIAL

MARTINS, ALEXANDRE AUGUSTO. **ARQUITETURA E CRISE: TÉCNICAS CONSTRUTIVAS PARA ABRIGOS PÓS-CATÁSTROFES NATURAIS**. PALESTRA. SÃO PAULO: FACULDADE DE ARQUITETURA E URBANISMO DA UNIVERSIDADE PRESBITERIANA MACKENZIE; OUTUBRO DE 2022.

CONTEÚDO PREPARADO COMO CONTRIBUIÇÃO INDIVIDUAL PARA A XIX SEMANA VIVER METRÓPOLE “E A SOCIEDADE?”, ORGANIZADA E REALIZADA PELA FAUMACKENZIE ENTRE 03 E 07 DE OUTUBRO DE 2022.

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Faculdade de
Arquitetura e Urbanismo


1952 – 2022



ARQUITETURA E CRISE

TÉCNICAS CONSTRUTIVAS PARA ABRIGOS PÓS-CATÁSTROFES NATURAIS

PROF. DR. ALEXANDRE AUGUSTO MARTINS

[XIX SVM – 2022.2S]

TECENDO UM LAR
[ARCHDAILY, 2022]