

THE UNIVERSITY OF MELBOURNE



ZEMCH

Dr Masa Noguchi

Associate Professor in Environmental Design Faculty of Architecture, Building and Planning Melbourne School of Design

Adjunct Professor School of Architecture (V-SPARC) Vellore Institute of Technology





Seminar Series In Architecture and the Built Environment

14th February 12:00 - 12:45

ZEMCH Environmental Experience Design for Mass Customisation

Prof. Masa Naguchi





Dr Mass Noguchi is an Associate Professor in Environmental Design at the Faculty of Architecture, Building and Planning, University of Mellocume, specialising in Environmental Experience Design (EXD)² decision-making analysis based on a mass outcomeation framework that embraoes machine learning and value engineering techniques for improvement of operational energy efficiency, offordability, and occupants' wellbeing in the built environment, in parallel to EXD studies, he also instrated global movement on zero energy mass outcom home (20MCO) and wellcal willow/mubdivison plag-in housing system research and development for future-proof sity evolution.



Coordination: Prof Patricia Tzortzopoulos : p.tzortzopoulosshud.oc.uk Mohanad Abobakr : M.Abobakr2thud.oc.uk

Innovative Design Lab (D4): https://www.net.hud.ac.uk/institutes.contros/idl/

Presentation Contents

ZEMCH

Mass Customisation

Environmental Experience Design (EXD)

Discussion for ZEMCH EXD R&D Opportunities





ZEMCH Network: Zero Energy Mass Custom Home R&D



ZEMCH NETWORK





Invite connections





EL Sco	ppus Preview	Q Au	thor Search Sou	urces 💿	Create acc	ount Sign in
Source	details				Feedback >	Compare sources 🕽
ZEMCH International Conference Scopus coverage years: 2019, 2021 Publisher: ZEMCH Network E-ISSN: 2652-2926 Subject area: (Engineering: Architecture) (Engineering: Building and Construction) (Engineering: Civil and Structural Engineering)					CiteScore 2022 0.2	٥
					SNIP 2022 0.095	0
Source type: Vecesitoreum CiteScore	Conference Proceeding	Save to source list Source Homepage	Applications) View all V		-∰ Export co	ntent for category
CiteScore r	ank 2022 💿	In category: Architecture	*	CiteScore	trend	
☆ ^{#149} 170	ZEMCH International Conference	0.2	12th percentile	0.24		100 90
Rank	Source title	CiteScore 2022	Percentile	0.18 Calc		70 60
#1	Design Studies	8.8	99th percentile	0.12 eScore		50 E E
#2	Developments in the Built Environ	iment 8.7	99th percentile	Ű 0.06		30 tegory 20 Y
#3	Journal of Building Engineering	8.3	98th percentile	0		10 0
84		10 10 10 10 10 10 10 10 10 10 10 10 10 1	32370000000000		2022	



Distriction and the second	BARKANA BERARK Henorita
WHEN PERSON AND ADDRESS OF	*****
The second secon	1
a' litterar. Willy-	-
Construction Construction	1999 C
HARDER STATES	BURNING BURNING
¥./	





Masa Noguchi Editor ZEMCH: Toward the **Delivery of Zero** Energy Mass Custom Homes

Springer Tracts in Civil Engineering





an Open Access Journal by MOPI

ZEMCH International Research Series

Guest Editors

Prof. Dr. Haşim Altan, Prof. Dr. Shaila Bantanur, Prof. Dr. Carlos Torres Formoso, Prof. Dr. Antonio Frattari, Dr. Arman Hashemi, Prof. Dr. Jun Tae Kim, Dr. Masa Nogachi, Dr. John Odhiambo Onyango, Prof. Dr. Trans Anissa Jahet Apd, Prof. Dr. Sara Jane Wilkinson

and picture last \$2587

Welcome to read

FACTOR

3.251

3.9

encyclopedia Encyclopedia of ZEMCH Research and

Development

Masa Neguchi, Antonio Frantan, Carlon Tomes Formoso, Hagen Atan, John Ochiambo Onyango, Jan Tan Kim, Hinina Anina Tabet Anal, Mahdi Anakham, Sana Jane Willimon, Shalla Bantanar (Eds.)

ZEMCH







ZEMCH 2019 International Design Workshop



November 19 (Tue) ~ 25 (Mon), 2019

Y YaleyOlong sunit Secul. South Kones (http://picales.org/)

November 26 (Tue), 2019

The Korea Science and Tachnology Center, Seoul, South Ranea - International Convention Center Pitter/Vice.kbfat.or.kr/l

Registration

September 06, 2019: Last date of registration September 13, 2019: Confirmation by ernel

http://www.aemch20119yepul.org. https://www.facetook.com/groups/540769963065930/ Contact: archaram040jigmail.com



Harrison In 19990 - Contest. Manual Activities



International Processing Communities Functional very universe tops to ensury converting to

of supervision and write the evidence of the ting, the importance of the mark we do

ae Kim ttee Chair











Springer Tracts in Civil Engineering

Masa Noguchi Editor

ZEMCH: Toward the Delivery of Zero Energy Mass Custom Homes













M.Arch in Digital Technology in Buildings

ABOUT THE PROGRAM

Given the technological change in the realm of design, the moment has come to pursue evolutionary ideas, creative design approaches and improved co-ordination techniques.

To meet sustainable standards, this two year masters programme offers Industry collaborated exploratory and experimental avenues for architects into the perfect intersection of architecture, digital technologies and construction.

Eligibility

- No Entrance Exam
- Pass with 60% marks in Bachelor of Architecture from a CoA Recognised University/Institute

PROGRAM HIGHLIGHTS

- BIM integrated Curriculum
- Form finding techniques for sustainable geometries
- Informed decisions on energy usage in buildings
- Apt for Research oriented curricular opportunities
- ulti-Dimensional career scope in Construction,
 - v Institute partnership for joint sessions Collaboration with Reputed International





Stay Tuned for other Updates and Application Information

Contact

E-mail vsparclife@gmail.com Phone No. +91 9443805240



ZEMCH











ZEMCH Mission to Japan Technical Study Visits 2006 - 2023







































INDUSTRIALIZED ZERO ENERGY MASS CUSTOM HOMES

- Sekisui House builds industrialized custom home.
- About 60,000 parts in a house.
- Provide a stable performance and quality in all of the houses.
- Producing a large number of parts in the factory.
- 95% automated production lines in some factories.
- 100% recycling of waste at all our factories.







NET ZERO ENERGY HOUSES





The window is also big, bright and comfortable house

Zero Energy House market in Japan



Sustainable Open Innovation Initiative provides the ZEH delivery details https://sii.or.jp/zeh/builder/search

ZEH ratio







omebuilder types & general design approaches

- Production Builder : Speculative (or production) design
- Semi-custom Builder : Semi-custom design
- Custom Builder : Custom design

	STANDARDISATION LEVEL	CUSTOMISATION LEVEL
Ready-built home	High	Low
Semi-custom home	Medium	Medium
Custom home	Low	High





Mass Customisation



Customised Products

"Mass Production of Individually Customised Goods and Services"

(Source: Pine II 1993 & Georg Cantor)



Habitat International

Volume 29, Issue 2, June 2005, Pages 325-336



A 'mass custom design' approach to upgrading conventional housing development in Mexico

Masa Noguchi^{a,*}, Carlos R. Hernández-Velasco^b

^a McGill University, 6890 rue Lacroix #3, Montreal, Quebec, Canada H4E 2V3 ^b University of Glasgow, UK

Received 22 May 2003; received in revised form 16 June 2003; accepted 18 November 2003

Abstract

In order to maintain the *economics of large-volume work* that help reduce construction costs, homebuilders in Mexico tend to *mass produce* low-cost housing using conventional methods and targeting low- and middle-income earners before having buyers for the units. Even though these homes respect a *minimum* of housing quality as defined by *housing institutions* such as governmental bodies providing financial assistance via loans provision, homebuyers appear dissatisfied with these *ready-built shelters* that barely meet their housing requirements.

In order to identify today's market demand for new homes in Mexico, the authors surveyed some typical low-cost housing developments located in Aguascalientes – a middle-sized city located in the central part of the country. The authors visited construction sites and conducted personal interviews with selected homeowners. Based on their observation of such housing developments, the authors found that many homebuyers 'extensively' modify their new home immediately after occupancy. This need to personalise their new house may be explained in part by the lack of *customisability* in housing design at the purchase stage.

This study therefore sought to introduce a 'mass custom design' approach that may bridge the production gap between the need for the mass production of housing that helps lower selling prices and the need for the design customisation required by today's consumer. This paper also examines the potential effects of this new design approach on the delivery of conventional, low-cost housing in Mexico.

Keywords: Low-cost housing: Mass customisation; Mass custom design; Mass custom home; Mexico





Low energy mass custom home








































Standardisation vs. Customisation

	STANDARDISATION LEVEL	CUSTOMISATION LEVEL
Ready-built home	High	Low
Semi-custom home	Medium	Medium
Custom home	Low	High









Donside Urban Village Aberdeen, Scotland



Donside Urban Village Aberdeen, Scotland



Mass Customisation for Experience Design



Product Design "Book Cart"

User Choice : Shelves



USER SELECTED: Two sloping and Fixed Shelves





User Choice : Handles

USER SELECTED: V-shaped, Vertical Handles



User Choice : Wheels



USER SELECTED: Six Wheels and Metal Plate connectors







Book cart designed through mass customisation of user experiences



RATHDOWNE PLACE AGED CARE CENTRE Melbourne, Australia

- 162 beds
- 12 Levels
- Care available
 - Permanent residential care
 - Memory support
 - Palliation
 - Respite care
- Better Together[®] model

SPATIAL ZONES





Level 5



Level 5 Rooftop Balcony



Typical Reception, Dining and Kitchenette



Level 5 Rooftop Balcony





American Journal of Environmental Experience Design (AJEXD)

Zero Energy Mass Custom Home (ZEMCH) Network

VOLUME 1 ISSUE 1 (2022)



American Journal of
Environmental Experience Design (AJEXD)
X D

RADIAL Sour

About the Journal

The Antonican journal of Environmental Experiment Earlies (QEDE) is an open science and double Mord pare recommend transmittened journal that publishes articles in themes Solis part is a decays, science, engineering, solitering and humanities. The AECE environment to prevente a planar planar here the science partners of decays: decay and humanities are conserved of services decaystras. Accounty on National Nationary Inter Solit, received of services decaystras, decaying on National Nationary Inter Solit, received and partners decaystras, decaying and humanitation accounted Services, The AECO revenue papers while the thereives partners from of humanitations, accepted which is of the learners decaying and interview partners.





Editorial Team

Co-Editors-In-Chief



Masa Noguchi

The University of Melbourne

Australia



Kheira Anissa Tabet Aoul

United Arab Emirates University

United Arab Emirates

My home improvement project through "Environmental Experience Design" theme







Edible Garden for Healthy Affordable Food & Children's Green Experience





Fresh Breakfast from Garden






🚣 🚟 High Density Housing Development



Urban Scenario, Dhaka

Uttara Residential Model Town, Dhaka



Japan Garden City, Dhaka



 Shopno-Nagar Housing, Dhaka (Photos: Chowdhury, Web source)

Concord Lake City, Dhaka



Field Data Collection



Field Data Collection



Field Data Collection



Data Samples

Total sample collections (nos)95Total sample Selections (nos)50

Climate		Summer			
Final selection for an	alysis (nos)	50			
Criteria				Criteria	
Orientation		Data considerat	tion (nos)	Floor level	Data consideration (no
East		11		Тор	16
West		14		Middle	23
North		11		Bottom	11
South		14			
Climate		Winter			
Final selection for an	alysis	25			
Criteria				Criteria	
Orientation		Data considerat	tion (nos)	Floor level	Data consideration (no
East		9		Тор	9
West		9		Middle	9
North		3		Bottom	7
South		4			
Criteria			Crit	eria	
Flat size (sqft)	Sample	(nos)	Bull	ding height (s	storied) Sample (nos)
400 - 600	4		1 10	6	20
(+) 800 = 800	3		7 to	10	21
(*) 800 - 1000	25		111	o 15	7
(+) 1000 - 1200	16		up t	0 15	2
(+) 1200 - 1400	2				

Participants: +18 years old







	Aperial Industors	-	Existing Condition or/spectropy:		100	Pairing Comfortuble Incidential Incident		Puture Preference address solice		
•	Suga inwahi.	1.0m 100	Mediati-	12	Low any	Medium unity	12	44	Medium	12
2	Indoor clenate Control wasagiby villow.Rept				0			0	0	
1	Phasy article confirm		0	-	u	0	-	0	0	-
2	Functional Identity any-method (workedding)	0		0	0		0	0	0	
2	Salety and Security Remains grave	0		0	0		0	0	0	
1	Space Unability BOAR EXPERIMENT	0	0		0	0		0	0	
*	Changesbilly (Variety) volkestedbrar		0	0	0			0		0
4	Anthenics Quality (Arrifle) workframe		0	0		0	0	0	0	
*	Floating of Docor weithing (Hilderr		0	0		0	0	0		0
i. N	Interaction and Sociability /Ind/Jan a rest/Januer		0	0	0		0	0		0
4	Charliness wilkes wildpror	0		0	0		0	0	0	



-	Apultal Indicators	6.	uting Cané at Super Nea	Wen.	Peeting Comfortable Intervention Intyp70			~	Future Preference utilities software			
•	dige invair.	1.04	Badium ITTY	100	1.04	Medium.	100	1.04	Medium VEV	100		
1	Industr climate Control warrydfr reficien Aloger	0	1	٠	0	1	0	0	0	1		
1 .74	artuft curriture		٠	٠		0	1	0	0	1		
1.70	Functional identity ani-mathem.conductions	0	1	٠	0	1	0	0	0	1		
1.00	Bahly and Becurity Remember a spreet	0		٠	0	1	0	0	0	1		
1	Space Usability BONG CONTROL OF THE	0		1	0	0	1	0	0	1		
1	Champeublits (Variety) Hillesfee®mar	1		٠		1	0	9	1	0		
1	Acaterics Guality Acaterics and Ameri	1	٠	٠	1	0	0	0	0	1		
*	Fieldity of Choice wellers/PEars	1		٠	1	0		0	1	0		
3 .64	Interaction and Excluding Recipite a restriction	1		٠	0	1	0	0	1	0		
19 240	Cleaniness without without	0		٠		1	0	0	0	1		

1 Sample Set = ± 1800 Data

50 Samples = ± 90,000 Input







121-0-00	1	3 2		x			CÍ
octors	List of Items		Itemsets	Support	Count		Itemsets
1	{X1, X2, X5}		{X1}	7		- 9	{X1, X2}
2	(X2, X4)	Scan (I)	(X2)	8	From (X)		{X1, X3}
3	(X2, X3)		{X3}	6	,		{X1, X4}
	(X1, X2, X5)		(X4)	3			(X1, X5)
5	{X1, X3}		{X5}	3			{X2, X3}
6	{X2, X3}	-					{X2, X4}
7	(X1, X4)		2	-			(X2, X5)
8	(X1, X2, X3, X5)	•	Suppo	on		٦.	{X3, X4}
9	(X1, X2, X3)						{X3, X5}
10	(X1, X2, X3, X4)					1	{X4, X5}
	T			A		1	
				Scan (I)		1	
	C2		C3			č4	
temsets	Support Count	Itemsets	Min. Su	pport	Itemsets	Sup	port Count
(1, X2)	5	{X1, X2}	5		{X1, X2, X3}	3	
X1, X3)	4 If Min Support =	(X1, X3)	4 If Min	Support = 3	{X1, X2, X5}	3	
X1, X4}	2	> (X1, X5)	3 C	3-+64		τ.	
X1, X5}	3	(X2, X3)	5				
X2, X3)	5	{X2, X5}	3				
X2, X4}	2					T	
X2, X5}	3						
X3, X4)	1						
UR UPS	1						Lift (X
A3, A5)							= 75 =

SN	Antecedent	Consequen t	Support %	Confidence %	Lift
1	PE-M	IF-M	38.00	94.74	1.32
2	FE-M	FF-M	38.00	94.74	1.48
3	HC-L	IF-M	32.00	93.75	1.30
4	PC-M	IF-M	42.00	90.48	1.26
5	FC-L	IF-M	40.00	90.00	1.25
6	QE-M	FF-M	34.00	88.24	1.38
7	QE-M	IF-M	34.00	88.24	1.23
8	TC-M	IF-M	34.00	88.24	1.23
9	TE-M	IF-M	32.00	87.50	1.22
10	AC-M	EF-H	48.00	87.50	1.46
11	CE-M	IF-M	46.00	86.96	1.21
12	KE-M	IF-M	30.00	86.67	1.20
13	EC-M	IF-M	44.00	86.36	1.20
14	CC-M	IF-M	42.00	85.71	1.19
15	GC-M	IF-M	54.00	85.19	1.18
16	FC-L	EF-H	40.00	85.00	1.42
17	GE-M	IF-M	50.00	84.00	1.17
18	MC-M	VF-L	36.00	83.33	1.54
19	MC-M	FF-M	36.00	83.33	1.30
20	GE-L	MF-H	36.00	83.33	1.19
21	UE-L	MF-H	48.00	83.33	1.19
22	EE-M	IF-M	48.00	83.33	1.16
23	RE-M	IF-M	70.00	82.86	1.15
24	LC-M	IF-M	70.00	82.86	1.15
25	HE-L	IF-M	46.00	82.61	1.15
26	GC-L	JF-H	34.00	82.35	1.58
27	GC-L	MF-H	34.00	82.35	1.18
28	CC-H	VF-L	34.00	82.35	1.53
29	CC-H	TF-H	34.00	82.35	1.33
30	QE-M	EF-H	34.00	82.35	1.37
31	BC-M	IF-M	44.00	81.82	1.14
32	ME-M	FF-M	44.00	81.82	1.28
33	SE-M	IF-M	76.00	81.58	1.13
34	NC-M	IF-M	54.00	81.48	1.13
35	FE-L	IF-M	54.00	81.48	1.13
36	HC-L	UF-M	32.00	81.25	1.31
37	JE-M	IF-M	42.00	80.95	1.12
38	HC-M	IF-M	52.00	80.77	1.12
39	NE-M	IF-M	52.00	80.77	1.12
40	LE-M	IF-M	62.00	80.65	1.12
41	SC-M	IF-M	72.00	80.56	1.12
42	NC-L	MF-H	30.00	80.00	1.14
43	KE-M	FF-M	30.00	80.00	1.25
44	EE-H	NF-H	30.00	80.00	1.54
45	FC-M	FF-M	50.00	80.00	1.25

	if — — —	- ÷	► then			
Ante	cedent		Consequent	Support %	Confidence %	Lift
Indoor Cli Comfor Me	mate Control t Feelings edium	F	Space Usability uture Preference High	48	85	1.42
Aesthet Comfor I	ics Quality t Feelings ₋ow	F	Cleanliness Future Preference High	34	82	1.58
Air Qua Comfoi I	ality (Dust) t Feelings ₋ow	N F	latural Ventilation Future Preference High	30	80	1.14
Day Physica Me	lighting I Condition edium	; F	Social Interaction Future Preference Medium	30	86	1.20
Master	Bedroom	Floor Level Orientation	East West North South Top Middle Bottom	Climate Summer Winter	Assoc	iations

BE-H = Privacy of Existing condition >>> High

BC-M = Privacy of Perceived comfort level >>> Medium

BF-L = Privacy of Future preference >>> Low

	Fir	st Lette	r		Second Letter	Third	Letter	
Code	Spatial Factors	Code	Environmental Factors	Code	Factors	Code	Factors	
Α	Indoor Climate Control	К	Daylighting Quality	E	Existing Condition	L	Low	
в	Privacy	L	Artificial Lighting Quality	С	Comfort Feeling	М	Medium	
С	Functional Identity	М	Natural Ventilation	F	Future Preference	Н	High	
D	Safety and Security	Ν	Air Quality (Dust/Pollution)					
Е	Space Usability	0	Indoor Temperature					
F	Changeability (Variety)	Р	Acoustical Quality					
G	Aesthetics Quality	Q	Smell/Odors Quality	An	tecedent •	6 > -	hysical Co	ondition
н	Flexibility of Choice	R	Texture & Color Quality		leccaent	P	sychologi	cal Condition
Ι	Interaction and Sociability	S	Quality of Materials					
J	Cleanliness	Т	Outdoor Connectivity	Cor	nsequent <	E > Fi	uture Pre	ferences
		U	Indoor Natural Elements					
		V	Microbe & Mold Growth					

East

SN	Antecedent	Consequent	Support %	Confidence %	Lift
1	VC-H	KF-H	54.55	100.00	1.83
2	IC-M	EF-H	63.64	85.71	1.35
3	IC-M	JF-H	63.64	85.71	1.35
4	IC-M	CF-H	63.64	85.71	1.35
5	AC-M	DF-H	54.55	83.33	1.53
6	AC-M	EF-H	54.55	83.33	1.31
7	AC-M	JF-H	54.55	83.33	1.31
8	AC-M	CF-H	54.55	83.33	1.31
9	JE-H	KF-H	54.55	83.33	1.53
10	FC-M	KF-H	54.55	83.33	1.53
11	CE-M	KF-H	54.55	83.33	1.53

West

SN	Antecedent	Consequent	Support %	Confidence %	Lift
1	TE-L	MF-H	50.00	100.00	1.17
2	AC-M	MF-H	50.00	100.00	1.17
3	EC-M	MF-H	50.00	100.00	1.17
4	UE-L	MF-H	71.43	90.00	1.05
5	RC-M	MF-H	71.43	90.00	1.05
6	LC-M	MF-H	71.43	90.00	1.05
7	VE-L	MF-H	71.43	90.00	1.05
8	NC-M	MF-H	71.43	90.00	1.05
9	RE-M	AF-H	71.43	90.00	1.26
10	RE-M	MF-H	71.43	90.00	1.05

South

SN	Antecedent	Consequent	Support %	Confidence %	Lift
1	IE-M	TF-H	78.57	90.91	1.16
2	IE-M	MF-H	78.57	90.91	1.16
3	VE-L	GF-H	78.57	90.91	1.16
4	FC-M	SF-M	71.43	90.00	1.40
5	IC-M	TF-H	71.43	90.00	1.15
6	IC-M	MF-H	71.43	90.00	1.15
7	UC-M	TF-H	71.43	90.00	1.15
8	UC-M	MF-H	71.43	90.00	1.15

North

SN	Antecedent	Consequent	Support %	Confidence %	Lift
1	QE-M	EF-H	54.55	100.00	1.57
2	LC-M	EF-H	72.73	87.50	1.38
3	SC-M	EF-H	63.64	85.71	1.35
4	IC-M	EF-H	63.64	85.71	1.35
5	IE-M	EF-H	63.64	85.71	1.35

Master Bedroom (Summer)

Тор

SN	Antecedent	Consequent	Support %	Confidence %	Lift
1	LE-M	MF-H	62.50	100.00	1.23
2	KC-H	MF-H	62.50	90.00	1.11
3	LE-M	TF-H	62.50	90.00	1.20
4	SC-M	EF-H	68.75	81.82	1.45
5	SC-M	CF-H	68.75	81.82	1.31
6	OE-M	MF-H	68.75	81.82	1.01
7	LC-M	MF-H	68.75	81.82	1.01

Middle

SN	Antecedent	Consequent	Support %	Confidence %	Lift
1	HE-L	JF-H	43.48	80.00	1.84
2	AC-M	EF-H	43.48	80.00	1.42
3	PC-L	MF-H	43.48	80.00	1.31

Bottom

SN	Antecedent	Consequent	Support %	Confidence %	Lift
1	EE-M	MF-H	63.64	100.00	1.38
2	EE-M	DF-H	63.64	100.00	1.22
3	IE-M	DF-H	72.73	100.00	1.22
4	IC-M	DF-H	72.73	100.00	1.22
5	SC-M	DF-H	81.82	88.89	1.09
6	LE-M	DF-H	81.82	88.89	1.09

Interpretation From Occupants' Experience to Design Customisation

		Own Carmed	Putter	Summer	Caribleon	clars Palence
		Long.	Concession, C.,	Common C.	-	Contraction of the local division of the loc
		FIELD REPORT OFFICE	1.000		-	Concern and the second
		Contraction of the local distribution of the		1.00	-	Colores (conserve)
		And the state of t		the days	-	Control Control of Con
		Second Contractor			-	the local local parts
1 house	_	An South		1.04	-	Party of Contractory
		Scient Geostile	Table Bayer's			Teperor Condition
		Carolina carolina				Contraction Contraction of
		Acceleration Country		1.00		Padrural Internighten
		Assolution Quality		1.00	-	Charge Street and
		Analysis (and)	1.00		A	Network Incident
		frame (second	-		-	And Design Control
		Characteristics.		Market .		and the second second
		and the second		The first sec	-	the statement in some
and the second		to the second se		the second second	-	Contraction of Street,
	- 1	And the second second			-	
		THE PARTY OF THE PARTY OF	1.00		-	Contract Contract
		And in contrast, or		1.000	-	And a second second
		Space (Autority		Statut.	A	Talva Yollaho
		Adventure operation in some				Industry loads
		Name and Address of the other		Table 1	100	Taxan Indiana
		free out internet have		The local division of	-	(and the second se
		hours and an		The second se	-	Concentration of the same
					_	
		fulfiller Turnachilly			- 10	Nava Wildon
The state of the s	_	Index Origin Cardial		teature		"Manufaction of the second second
	- 1	Town institute		Table -	_	Marg Wellight
		And in the	Inches Inc.			Barry Barry
-	_			And a second		
		course related			-	des long
		Rectal Interaction	Wedness			California Conversioning
Sec.1	_	for all the action	100.00.01			Natural Internation
		Manufactured Decade	1,000			Annalistics (availy
					-	
		And the second	10.0.0 m			New Yorkston
-		Contraction (contra-			-	forund container
		And a strength	medium			College Connecteda
		Facility of Dates	1.00			Charlings
and the second		Andrew Chevrolet, Constant		The last	-	the second second
_	_	Annual States Street		1.000	-	Natural Statistics
		second hand leave		100	-	the second se
		Space Unabling	Marillan			Natural Ventilation
		NAMES OF ADDRESS	Maket -			Tables & Security
-		Record Advantages	Market -		10	Statute & Security
		Second Educations		Inches -	100	Sala & Secula
-						And the first states

						_	
1	hannar	-	Control Content 2 control Index Related Content Index Related Content Complete States Incomplete Content Incomplete Content	Papeter Date: Second State	Conceptor in the local division of the local		Careford Forderson
	-		Facility of Data		1.08	1	Charlens
ł	-	⊢	Chargest Mo Chargest Mo Chargest My Chargest My	1		:	Charlinson Reduced Translation Spaces Tradition Construction
	-		Inter Marco Conset Inter Marco Conset	10		2 –	Special Conditions
ĺ	**	-	Ar South Index Temperature Index Temperature Index Temperature		Madan Madan Medan	1	Natural Verification Characteristics Natural Verification Private
ŝ		-	Stati Salita Galita armanak Salar Tahari Danat Milang	1.00	No.	-	Paraller of Heritik Solder, & Secular Southy of Testanak Result recomment
	1.0	-	Frankright Lagrang		1.04	1	And Address
	-	-	Autor Nation Tartant Autority Config Incar Hermiter	lan Madan Lan		1	Advert Selfation Advert Selfation
	-	-	Index Nation Connect Security Haracelle An Condition Follow National Connect	Long Long	No.	1	Marcal Includes Marcal Includes Marcal Includes Annual Includes

		Shared Roots & Control	Physical	Pauringent	(antidence	Coars Preference
		the state of the s	Experience (F	Reportation (F	1941	(Part)
		Indust Oktado Daribut	Lin		11	Participation in the second
-		Change all the	BRIDLAN.		-	Tradition Committeelle
	- 1	Authorit Lighting		Madaget	41	Contractions Commentionly
1		Mundae recept fromb-				Elatitor Connectivity
		Munda mud broat		100		Patter Investation
		Charles and the second se			100	to the second second
	-		1.00			the dense processing in
		proof games		and the second s		Ser from Done, Append
		Manufacture of Consult.	1.00		47	Table & Security
		Accession South, Name		March 19	4.4	Status Temperature
	_	Manufacture of Contracts	1.00			Support Constraints
-	_	Marche doubt forces.	1.00		17	Cables Conseilable
		(Descendable)		Manham	1.7	Testuce Incidence
		1 Transmission		100000-000		Contract Contraction
					-	
		Toston & Ostor Goaldy		March 199	106	Dation Connecticity
		George of Materials	Wedges -		100	Database Conventioning
		Surger Internation		Madus -	100	Califier Contractives
-		Index Ratura Carneri	144		100	Enders Omge-Carried
		Salety & Secondar		Medium -	100	Contains Committee
		Functional Identity		Market -	10.	Natural Verifiator
		Social Discontinue		Modern -	100	Dation Converting
	- 1	(Transport May		100 M	10.00	Contract Converting
		And in case of		Mark Inc.	10	and out the state of
					-	
		of Street Lond		- and the second	-	and a second second
		Address Lagrange		Madeute	44	Califier Converting
i de la compañía de la compa		Overgenetitity	Western .			Contine Conventions
		facility internations		Medium:		Station Converting
					_	
and the second		Munite House Crowle	1.00		-	That and Thermation
	- 1	Months And Grouds	1.00		-	Contra Generative
			1.00			Charlos I
		Users' Earliest	Physical	Psychological	Cardidance	Users' Profession
		E-comp	Reprint and	Experience (C.	04	Proj.
		Index Natura Clement			_	National Territorium
		Outline: Connecteday	Lotan .		-	Natural Verifiation
_		Monte-matt fromh		Trinduction 11	- 1	Index Onute Control
	_	Indus Natura Camara		1.00	-	Total Charlenge
		Index Nature Centers	1.00m		#1	Antibatics Gaattle
		Index Network Electronic		Line .	-	Conductions (Sensitive
	- 1	and the second diversion of	1	_	10	A
		Table Served Densel	1.174		_	the second secon
-	_	Training & Section 10	199		-	NUMBER OF STREET
		Control & Descripting	- de		-	And and includes

	Users' Darland	Physical	Psychological	Cardidates	Users' Professore
	from a	Reportment (F)	Experience (5)	04	Proj.
	Indust National Clement				National Territorium
	Outline: Cannactudy	1.0mm		-	National Vacilitation
	Monte mat from		Median's	-	Index Orners Control
_	Indust Nature Clement		1.00	-	Topaca Country
	Indust Natural Content	1.000		80	Antibatics Guality
	Index Network Detection		1.04		Daylyting leadly
	Indone National Discount	1.00		11	Natural Vertilation
_	Taking & Texcurity	1998		-	NUMBER OF TAXABLE
_	Eating & Security	integral.		-	Roburg Translation
	Analisia Gastig		Medium		Refund Translation
	former (materies	Margare .			Natural Versiano.
	Apaca (Justilly	March 14		#	Osariment
	Arthur Lahing		Mallat .	- ii	Related Verification
	Manufacture (county)		1.000		Provide at
_	Republic Country	i der		-	Researce Charlenge
	Second Second	in the second se		-	Index Owner-Danked
	Wordshout Start		1.04		Sour Heradon
	And in cases		Market market		Name (Address)
_	Artiklariughting		Mohat.	100-	Antibulics Guality
	and the second diversity of				and the second second
	State of the second second				Part of the second second
	Manager of States and		10.0		Contraction of the state
	Contract of States			= :	and a second second
	Contra to contrast.		-	-	riske states carrier.
	Artificial Laboration	Wedness.			National Interdiation
	Fortune & Colour Southy		Modum		Australia: South
-	INCOME AND A	1.000			NAME OF TAXABLE
	An Country (Count)		March and	-	Coldina Connecteda
	An Genetic (Dent)		Medium		Indee Otrate Central
	As Guality (Dunit)	Medium -			interaction & Sociationy
_	Cashilly of Choice		Mollutt	H	Natural Intelliation
	Analysis Guilty	Maduat and		- C	Indoor Olevado Continal
_	Acathetics (postly)	Madeuro		-	Natural Invitiation
	Calificat Connectivate		Medium		Town I Automa
	Rear United		Medium.		bothto keth

....



_			_				
	Dary Lotted	Rend .	Partners of	0	Care Palence		
_	Constanting Constant	1.00	-	:	States - Constitution		
	Paneling of Contra			E	And Andrewson		
_	212	-	1.1.1	1	College Toronald &		
٦	Annual Concertioning Annual Concertion	10	-	-	Ar Luffs		

ļ

	-		-	-			
	-	April Salar Annual Social Salar Salar Salar Salar Annual Salar Annual Salar	Partie A	tantes.	-		
***	\neg	Annual Constants	10000 10000 10000 10000		1	NAME OF STREET	
***	-	A Long	1.00	Maria a	1	in Lab, Ballinson	
-	-	Andrew Marcola Charment Salition of Strategy	12		i.	Space making Solare in the set	
1.1	-	2277 marca		11-		Annual Incident	
-	-	Descentify the local data		Ballet .	=	the line later	
16	-	Ar Statts Automatic statts Automatic statts	12	10.0		NALY WRITE MALE WRITE	
	-	Same is foundly		B10.0.0	1	And Inc.	
Refer	\neg	Autoria Carly	1.00	No.	i	122	

Domestic Environment

Universit			(true	inter a	inter		
			Game Cardeni	Participa	Permission	Carlline .	Gard Palarana
			£100 g	Superiense (C	Digeneral II.	04	PH
			Indus Climate Carlins	1.00			Particip Confidence
			Statement Science		1.00	-	Party of Contractor
	bunner.	_	Contract of Contract of Contract	1.000	1.08	-	Concern Concerns
			Condition of Charters	-		-	And in the local division of the
			Conductions (Londo)		1.00		English Complete
						-	
			Active Related Classed			_	Antibulics (passily
		_	Warnite result from			-	Control Control of the
	_	_	The second second		120	-	Contract Contractor
			States and states	in the second seco		-	Contract Contraction
- 1			(hereiteren)		1948	-	Desilvence (see the
						-	
_	-	_	Words next load.	1.00			Charl Drann
		_	And the second locate	1.00		-	preservers a sustaina
I			And a stand roads		-	-	parts in the second
I		- 1	Destroy Later		1.00	_	Natural Includes
1		-	day (possibly	1.000		-	Chail and The Ballet
1	_	_	Privacy.	1,010		107	Palara Tertilatori
I			Reform Territology	1.000		-	Functional literation
			Natural Includes	108			These comments
			Index Natural Clement	100		100	Colorantee & Successive
	1000	-	Ar Loaths	10.0.0		1.0	principal de la factadade
			Works must longh		~~		Texas indeline
			Andrew Letting Letting		Madan.		States (restrict)
			Asher Dirate Techni	1.00		100	Caluary Vanilation
		_	new (was (see	100		100	And a local data
		- 1	Index Death Lotter	100			Castley Converting
		_	Chalifiers Conversion	1.00			Design Conception
		_	Accession in the second	March 199		-	Provence -
			Caultilly of Dama	1.000		10	Canal Cost Ma
			Andrew Lawrence Dought		March 10		and the second sec
	Bush	-	Andrea & Contrar South		Station 1	-	and one of the distance of
			Contract of Long Street,			-	
			Authority Southy		the first second	_	Parent Pratition
	-	_	and states	1.00		-	Contraction of the local division of the loc
		_	And the second s		and the second sec	-	Control & real safety
			And and a state of the state	No. of Concession, Name		-	

	Date:		the second	-		(mage
		Garn Carles	Payment	Partnergent	Continue	Users Preference
		A Long Tool	And in case of the local division of the loc	Concernance of	· · · · ·	A COLUMN TO A COLUMN
		Another treatly		Manham	-	Same Commence
turner	_	CONTRACTOR OF CASES	100			1000 110000
		Characteria	1.00			There is a second
		And the Charles Charles				Contra Conscient
		Charlense		mage.		Authority (sally
	_	Selara includen	-	Thomas .	-	Contraction of Security
	_	As Investor Proved	-	The second se		Contract Contraction
		Accession Deally Server	1.000			Contraction Communiteday
		Intel Listen Loads		Wedness		(netters)
		Salary Socialization				Same Parking
	_	Anticipation (particular)		maker -		And Links
	- i	index Temperature		Market and		Canadiana Canada Salaha
-	_	Page	1.00			Cublics Connectude
		itolico Temperature		March 18		Related Verification
		Marries and Street.		14	10.000	Seale Trades
	_	Works cost (cost)		- mile	- 10	Dation (secondary
•		Ar Guilty Burt		March 14		Adap Tanah Lanta
		Contracts		Westwood .		name Name Carried
and a	_	Acchiels Lowers		Bachure	R	Refure Contration
		Antician's group (scally		and the second		Conclosed liberidge
		Table (Bridde Cartes)		and the second s		Contract Contraction
		the second part of			-	
1.00	_	Transport & Contrast Country		and the second s		Calification Contraction
	- 1	Address' plans (such-		March 19		Advertising Classed
		to Deale Prod		-	-	And Design
March 1	_	An Income Courts		The second se	-	Automatica Streetly
	- 1	Concession in the local division of the loca	March 19		-	Contract Contractions
		inere a	-			Statement Process
	_	Guilde of Westman	Thinks .		10	Table & Terrativ
and an a	_	Ar Guilly (Exat)		Station .		Rokand Verifiakan
		An investig (Deal)		Tichel -	- 10	Contraction in the



Future Environmental Experience Design Research Trajectory





THE UNIVERSITY OF MELBOURNE

ZEMCH EXD Vertical Subdivision R&D

ETWORK









ntry ...

Re-Conceptualizing Vertical Subdivision Development for Sustainable, Affordable Housing Delivery

Nathan Tetleh * and Masa Noguchi 3

23MCH DDD Lab, Passiby of Architecture, Building and Planning, The University of Melinearne, Melinearne, VK 2020, Australia, masa negacitribiation/biodea.uu

Cerrospendence: v.tetach@uniaveth.onlu.au

Definitions Research on sustainable, attentiable hussing is evolving. Yet, its conceptual efficacy in light of the changing needs of today's cities and targeted less-to-middle-income households nemains unknown. In today's rapidly urbanizing sortid, understanding the conceptual relevance and importance of land use planning tools such as vertical subdivision to the delivery of sustainable housing is lemable. In wepome to this knowledge gap, this entry inquires, how can the delivery of attentiable basing be configured in a mariner that hereage the potential of a redefined vertical subdivision development to optimize densities and ensure that heuring attentiability is sustainable? Here, this entry is -defines vertical intedivision development as a housing planning and design heil that allows for the segregation of air spaces into individual volumetric land panels that marine the uw immental features of the land-en-ground, such that heaving construction within such volumetric spaces is a function of the contextually relevant ones of eccapants. This entry demonstrates a paradigm shift from existing housing infrastructure planning models and maratives to one that responds to and addownes all (here dimensions of sustainability: concomic joustainable atherdability), environmental (oustainable densities), and social (ecceptant wellness) in the housing infrastructure planning and delivery process.

Keywordse vortical subdivision development, sastaitable; affordable bousing; deroities; affordability; sullness

1. Introduction

The trend of urbanization in today's cities complicates the challenges relating to access to bossing and poses threats to the well-being of many urban residents. Worldwide, govemments often resort to alfordable bossing as one of the several approaches to providing adequate housing units for their city inhabitants [1,2]. In the literature, alfordable housing is often described by its main supply motive of improving housing alfordability often among low-to-middle-income households who are limited in their ability to compete in the mainstream housing market [3–6]. In most cases, this category of target households falls within the bottom 40% of the income distribution spectrum within the city [7,8]. The common measure of housing affordability is that occupants of a given household should ideally spend no more than 30% of their income on housing costs, such that other basic non-housing needs can be afforded [3,6]. The price-to-income index is criticized as overly focused on economic intentions [8–10], yet it still dominates planning decisions today as it allows attention to be paid to the acquisition and operation cost barriers that many low-to-middle-income households face in the bousing market [11,12].

With the advent of sustainability thinking toward the end of the 1980s, scholars argue that the science and policy of attendable housing should extend beyond price-to-income alfordability assessments to include the extent to which the housing delivery process and its outcome mapped to the broader needs of the occupants [13,14]. The concerns stem from the fact that occupants of affordable housing units, like any other urban dweller, require

Classics, Tettel, N., Negarata, M. Re-Conceptualizing Ventual Solution and Development for Statutistic, Allowable Housing Delivery, Crigaterial 2004, 6, 294–572, https://doi.org/10.2007 menu/opetualizitiest

sheck for

appilates.

Academic Editor Nature Escents

Reative 10 September 2011 Revised 24 Sensory 2024 Accepted, 1 Network 2024 Published 4 Petrospy 2024



Copylight © 2021 by the outlook Linease MINT, East, Switzerland, This article is an open acteus article distributed under the torus and resolutions of the Construct Consonant Articulations (CC PV) Income (Mays // construct-consension.org/Torume.'by/ EA/).

Employeds 3024, 4, 256-272, https://doi.org/10.3386/oncyclopedia4010026

ZEMCH

Humanity and Sustainability



ZEMCH | per may have latter more | belong 100

the second state of the se

Big Thank you

E