2014 .11.20 Tokyo, Forum 8

都市デザインと計画支援
Urban Design and Planning Support Using VR

Z. Shen （沈振江）
Kanazawa University, JP

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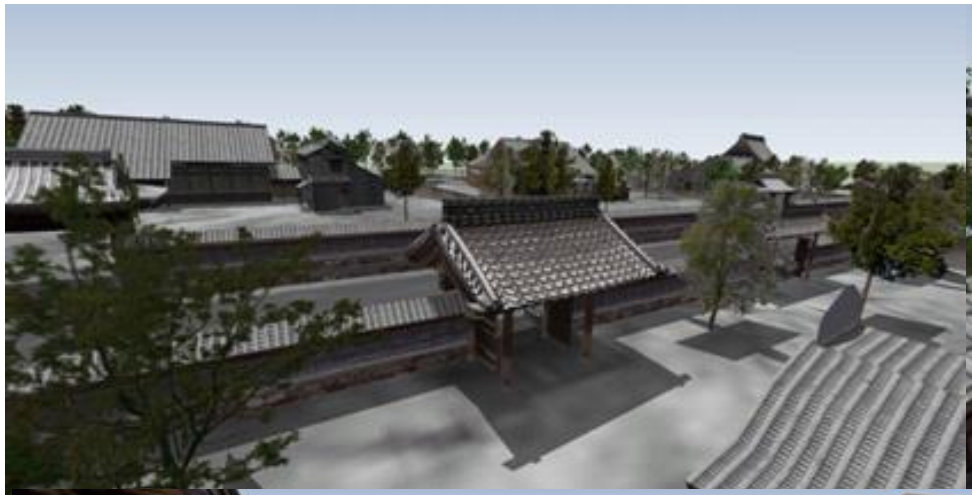
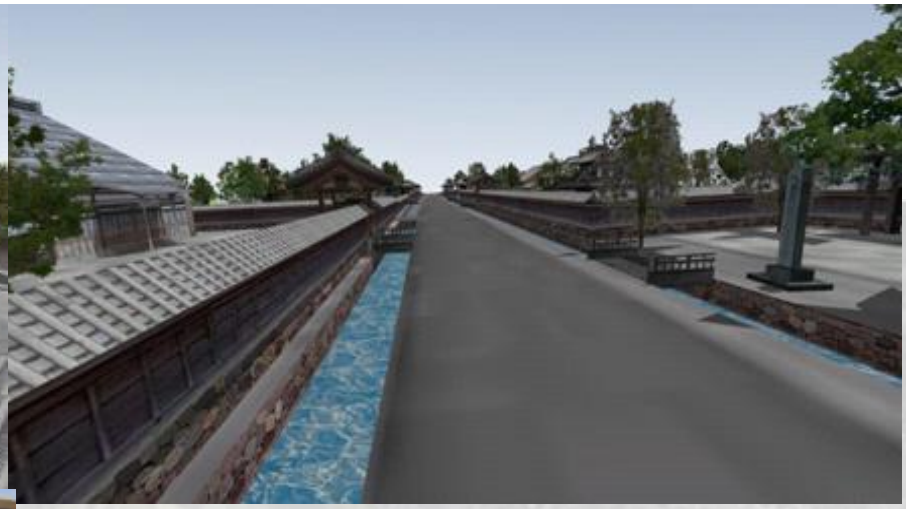
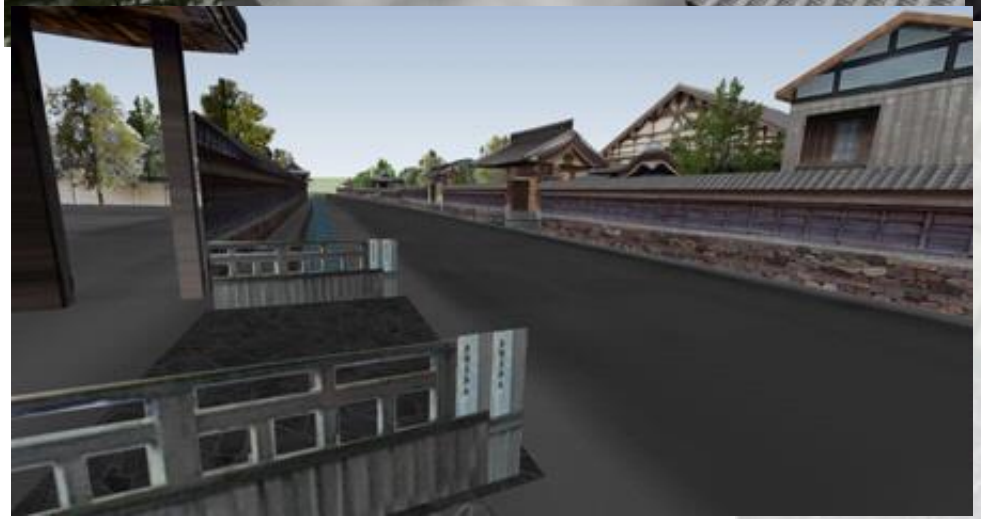
A image of new tool: Buildable space based on planning regulations

Presentation

◆ **A design tool using VR cloud computing (Google) for urban design**

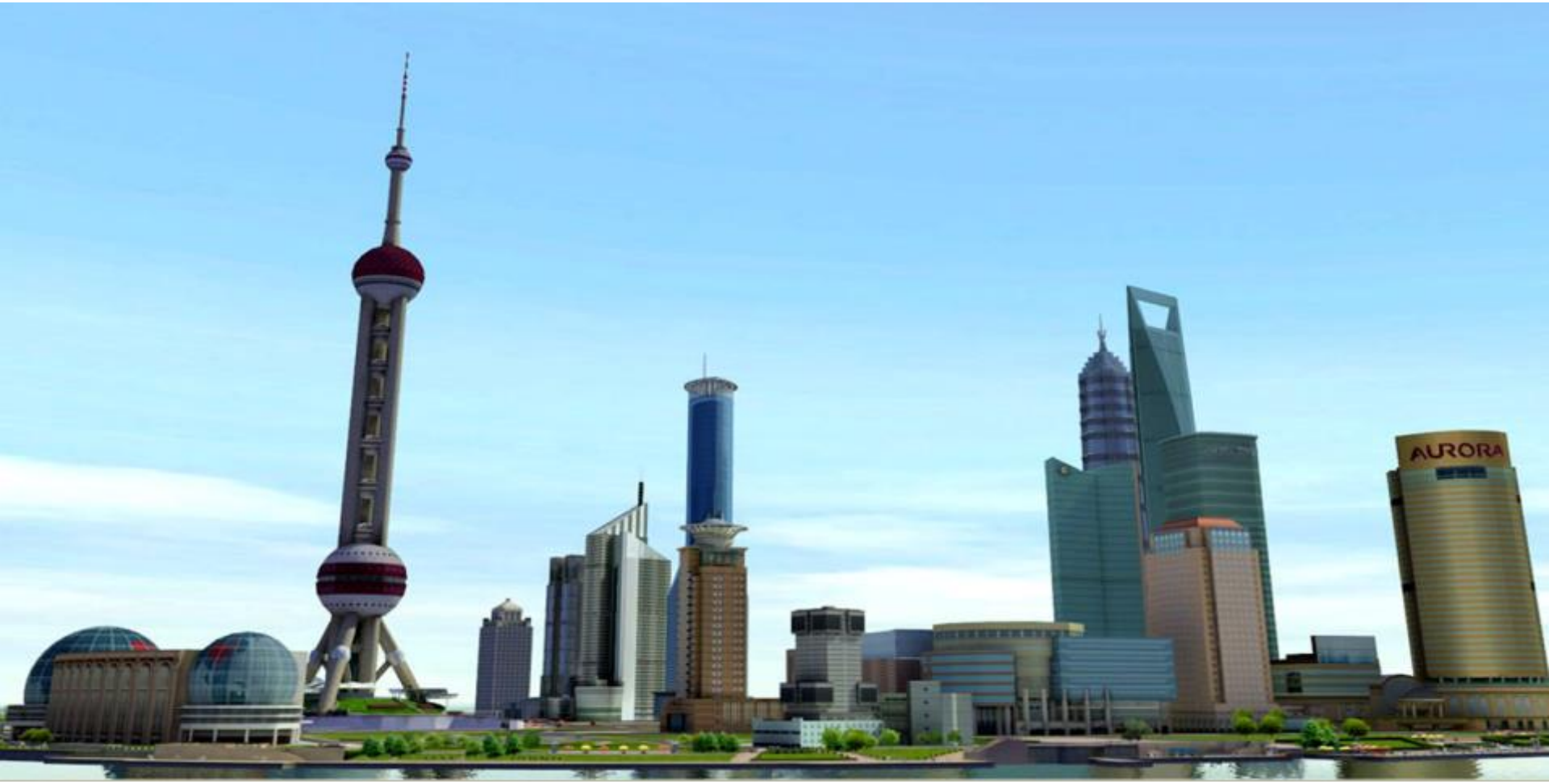






Teramachi District, Kanazawa
UIA Region IV
Architecture Preservation
Award
Based Google Tech.

Presentation for Lujiazui CBD Development Planning(Shanghai)



Presentation for Xiamen Station Development Planning

Presentation for Beijing Tiananmen Sqaure

Presentation for Olympic Game Main Stadium

Presentation

Planning representation
Planning Exhibition Hall

GviTech
http://www.gvitech.com

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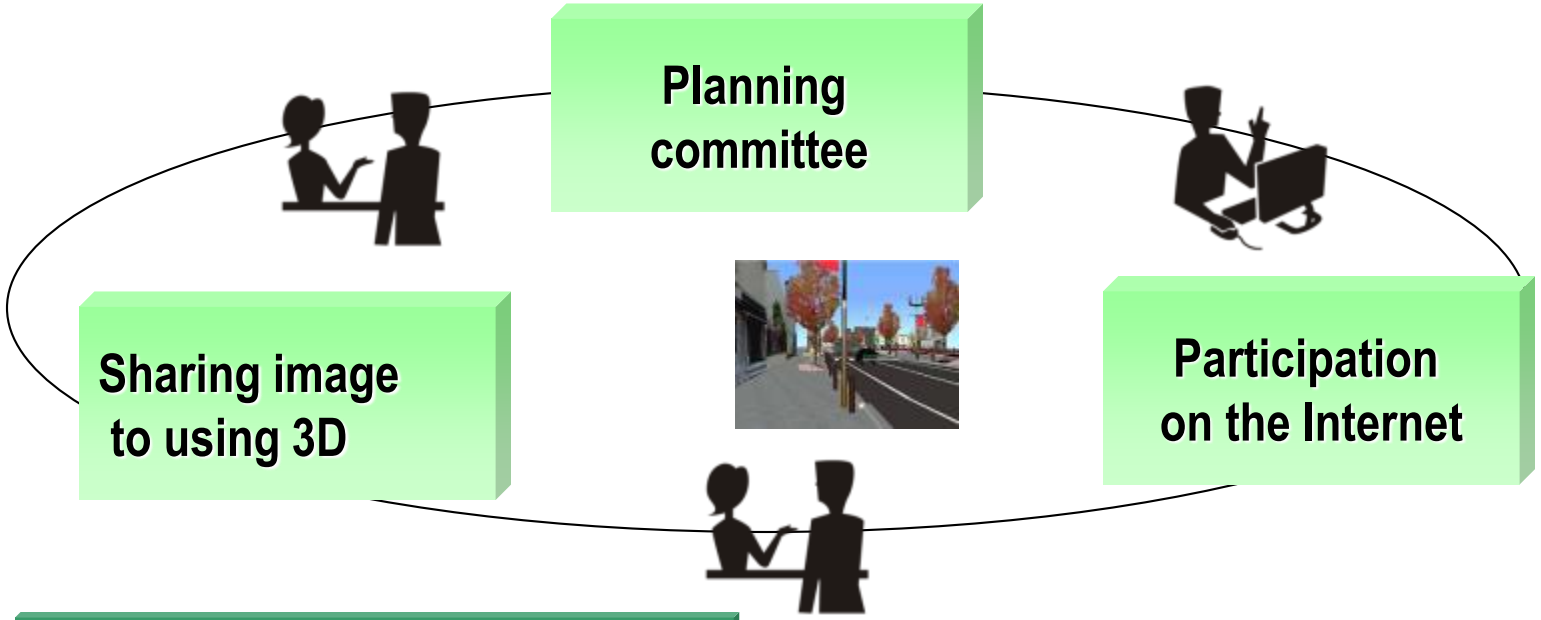
Planning Learning

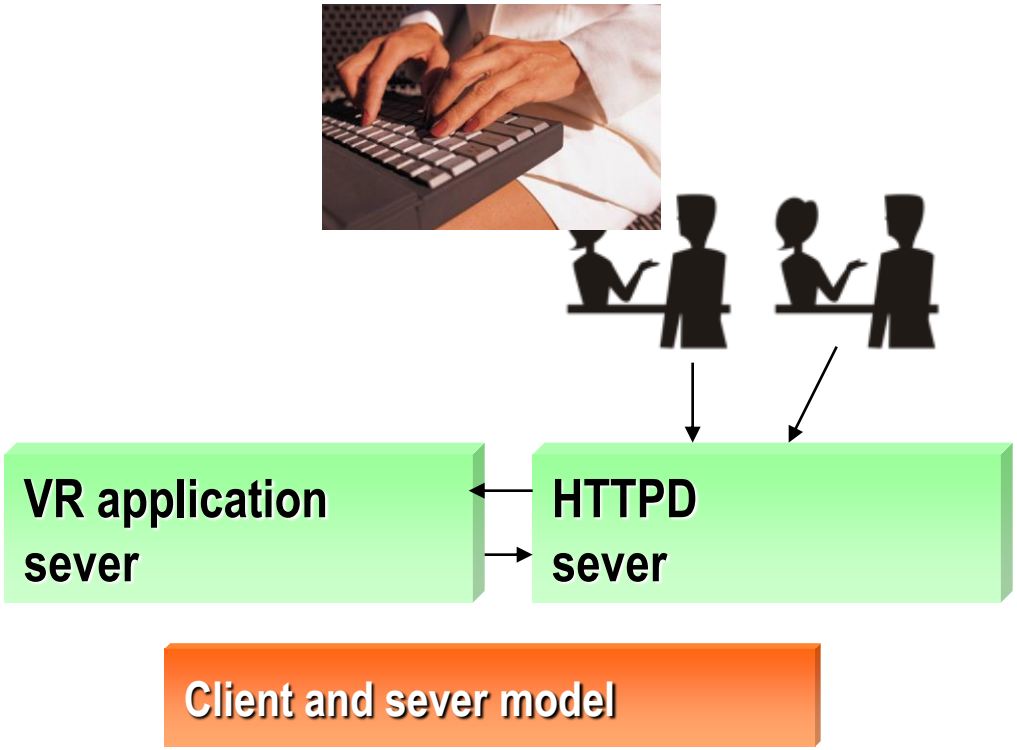
Planning support using VR to urban planning and design for public participation



A solution for planning support

Visualization of planning and design

A conventional model for planning support



A learning tool for studying planning regulation (JSPS)

Planning learning tool for stakeholders

↓

Buildable space based on building regulations

↓

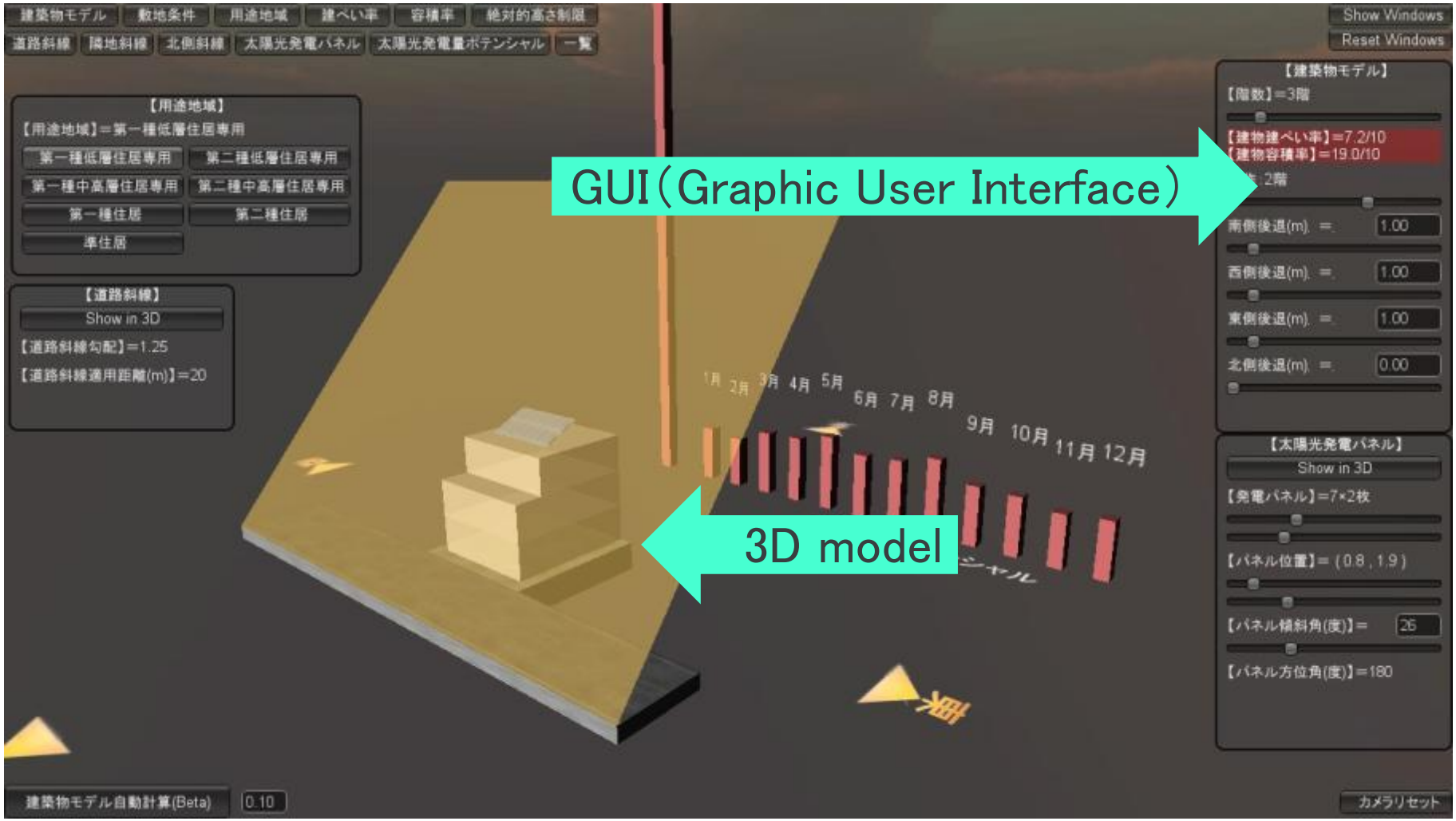
Simulating the buildable space

↓

Calculating the potential of electric power generated on roof

Planning Learning

◆A learning tool for planning regulation tool (JSPS,2008)



Regulation on building height

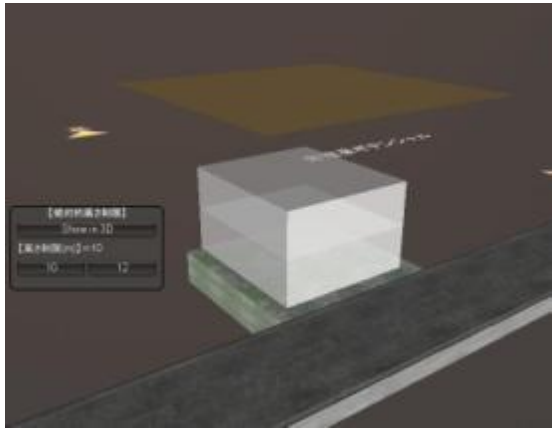


図13. 絶対的高さ制限 ＝ 10m

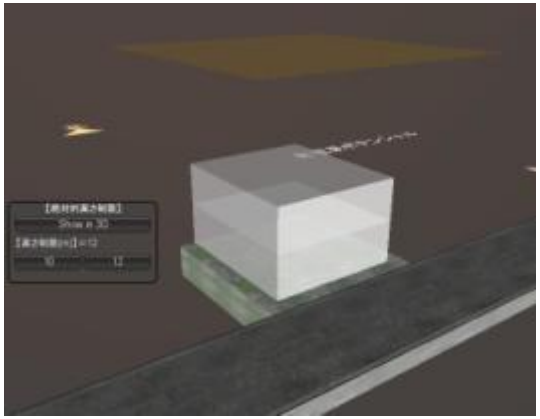


図14. 絶対的高さ制限 ＝ 12m

Oblique of front road

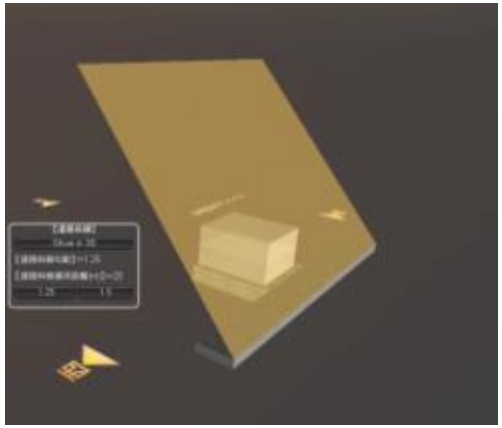


図15. 道路斜線勾配＝1.25　適用距離＝20m

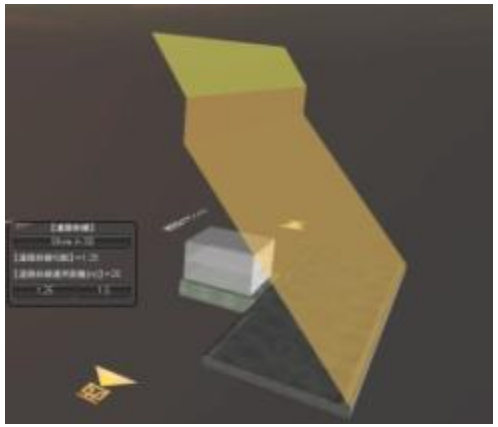


図16. 前面道路幅が12m超、道路斜線勾配＝1.25　適用距離＝20m

Oblique of neighbor lot

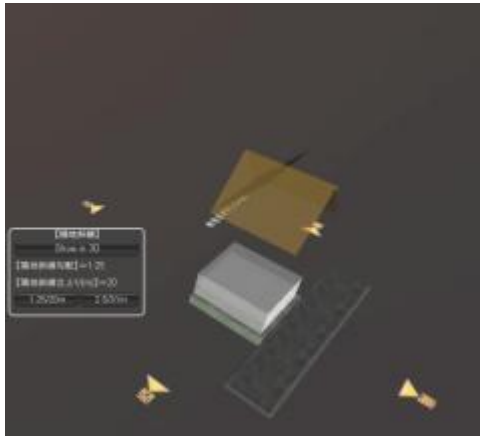


図19. 隣地斜線勾配＝1.25　立上り距離＝20m

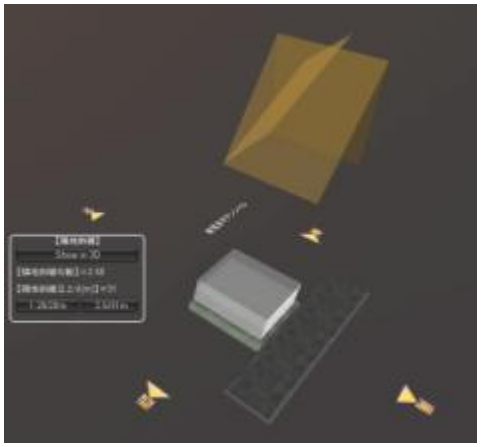


図20. 隣地斜線勾配＝2.5　立上り距離＝31m

Oblique of North side

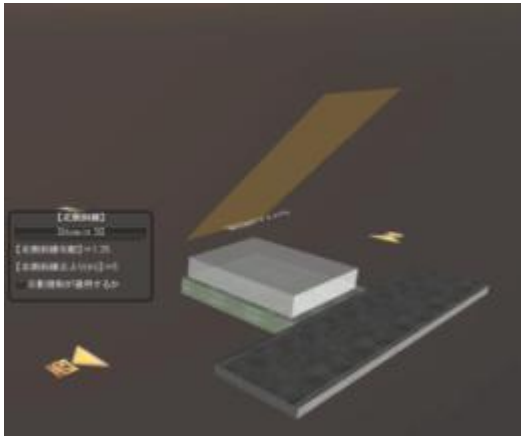


図21. 北側斜線勾配＝1.25　立上り距離＝5m

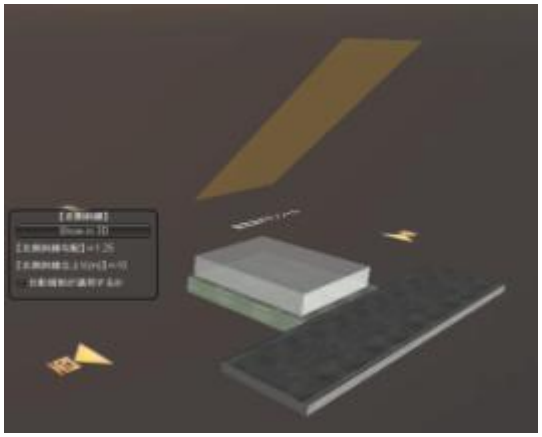


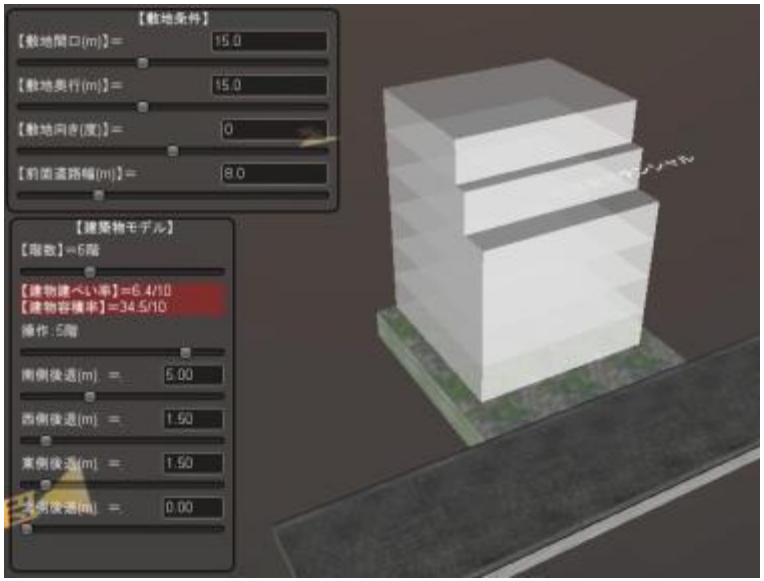
図22. 北側斜線勾配＝1.25　立上り距離＝10m

Buildable space

【Coverage of building space】

C：建ぺい率；
W：敷地の間口（m）；
D：敷地の奥行き（m）；

B_{E1}：第1階東側後退距離（m）；
B_{W1}：第1階西側後退距離（m）；
B_{N1}：第1階北側後退距離（m）；
B_{S1}：第1階南側後退距離（m）。



Buildable space

【Floor area ratio of parcel】

R：容積率；
n：階数；
T：外壁の厚さ（m）；

B_{Ek}：第k階東側後退距離（m）；
B_{Wk}：第k階西側後退距離（m）；
B_{Nk}：第k階北側後退距離（m）；
B_{Sk}：第k階南側後退距離（m）。

Automatically reshaping the buildable space based on regulations

本機能は、最大の屋上面積を求めるために、複数の斜線規制（道路斜線、隣地斜線、北側斜線）が適用される場合、建築できる最大な建築物モデルを自動計算できる補助機能である。

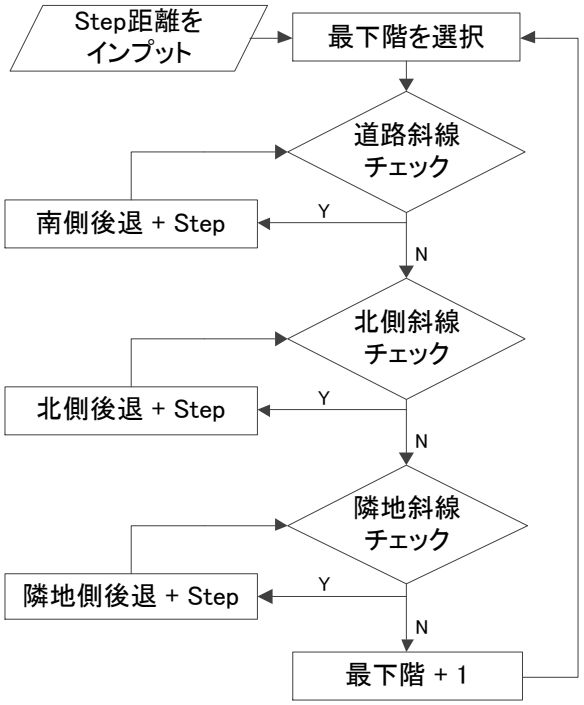
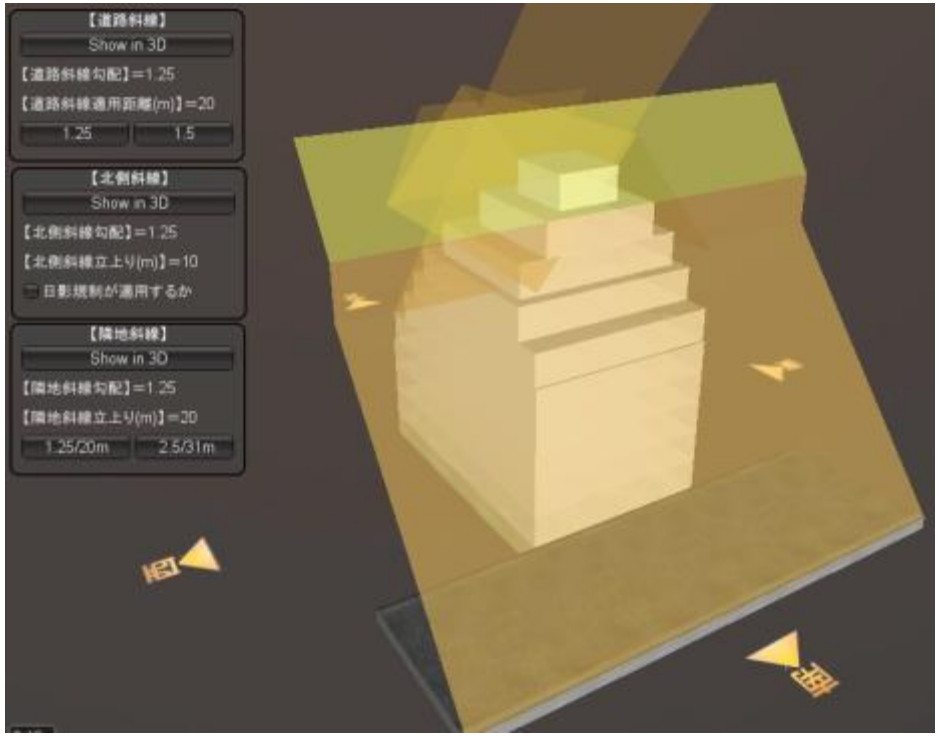
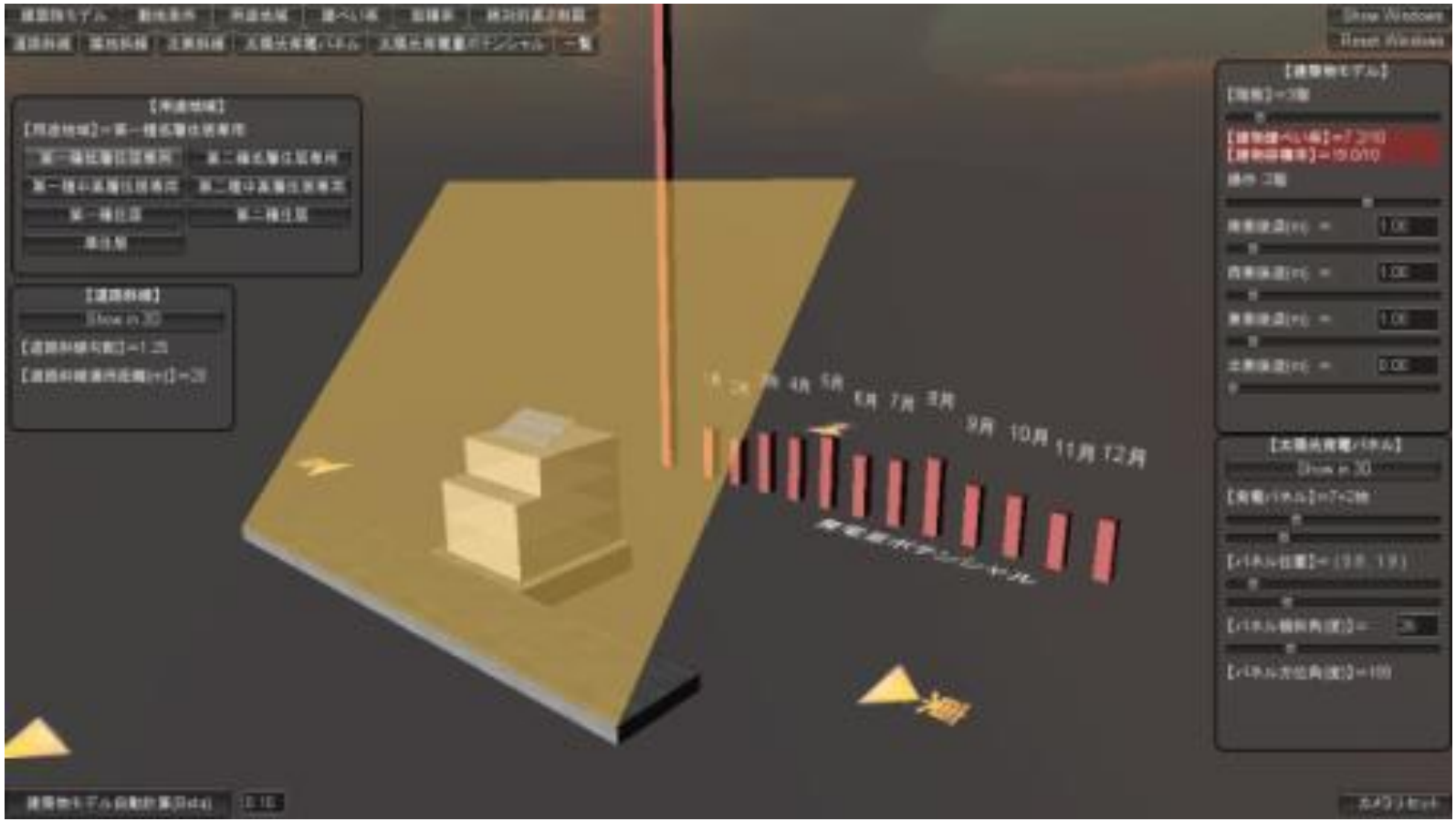


図24. 自動計算機能のフローチャート



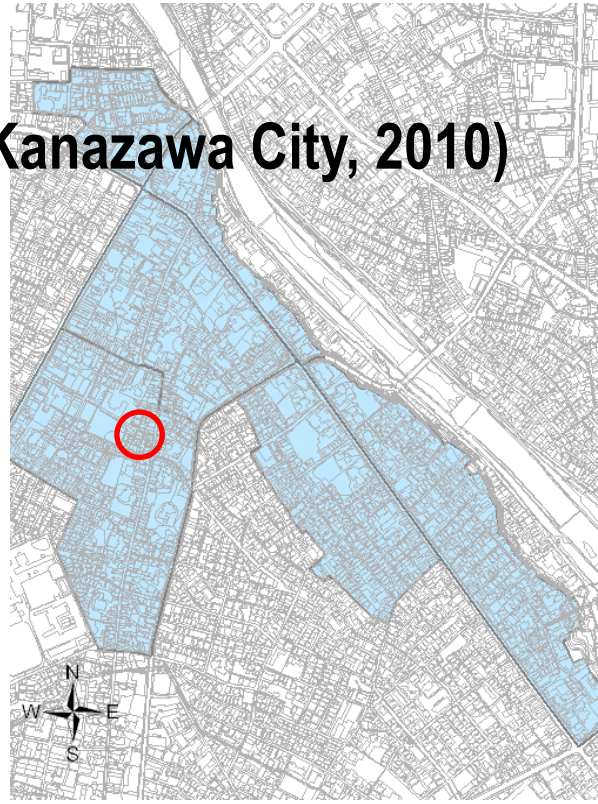
Auto shaped buildable space

Assign solar panel and calculate the electric power



Planning Learning

A learning tool for studying modified regulations (Kanazawa City, 2010)



- Teramachi is a densely built-up area with traditional buildings and historical road patterns
- Narrow roads with a zigzag pattern that effect on evacuation route and fire-prevention
- Impossible to rebuild because of planning regulations such as oblique line, FAR limitation of frond road in Building Standards Act

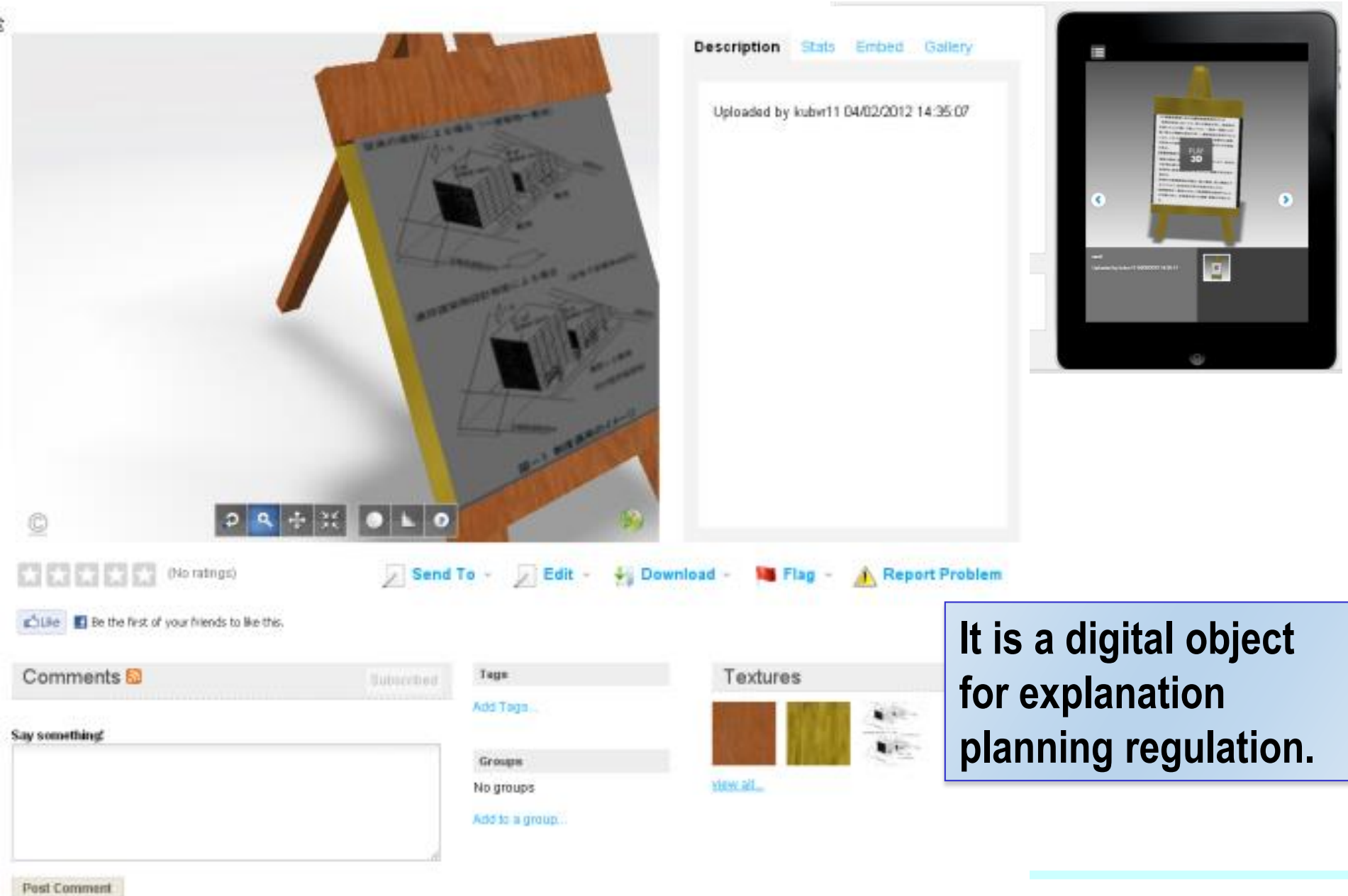
It is difficult to rebuild based on current Building Standards Act. However, residential environment need to be improved.

Regulations presented on panels

Users can prepare their digital assets after he/she register an account using 3DVIA

Users can prepare VR world using the digital assets within his/her database

Planning Learning

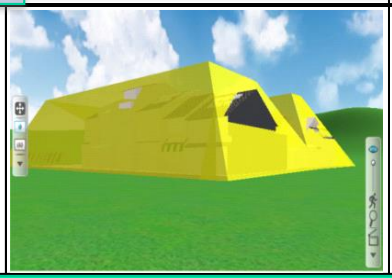


It is a digital object for explanation planning regulation.

Multi-user environment for studying

VR world for planning learning and communication within multi-user environment

Learning process of modified regulation on buildable spaces

Current townscape	Illegal parts based on general BSA	Rebuilding based on general BSA	Planning measure I	Planning measure II
				

Separated parcels

Planning Solution: All parcels are united as one parcel

Current Situation

Buildable Form in Yellow Color based on oblique line

Find out the illegal parts based on BSA

Buildable form based on set-back requirement from the front roads

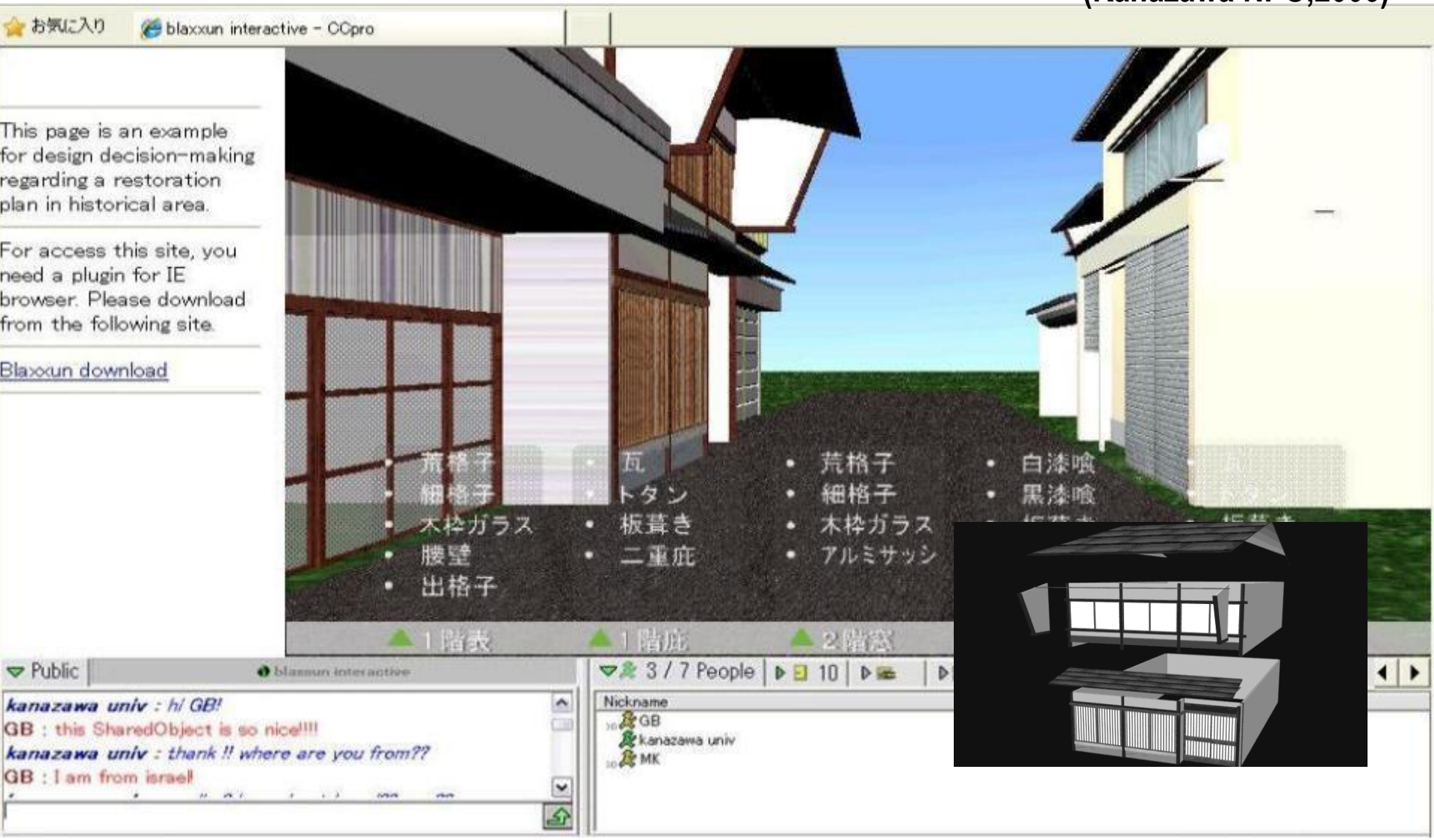
Not change the site layout

Change the site layout

Possible to rebuild based Special design code (e.g. oblique line can be withdrawn)

◆A learning tool for studying Traditional Townscape design

(Kanazawa NPO,2006)



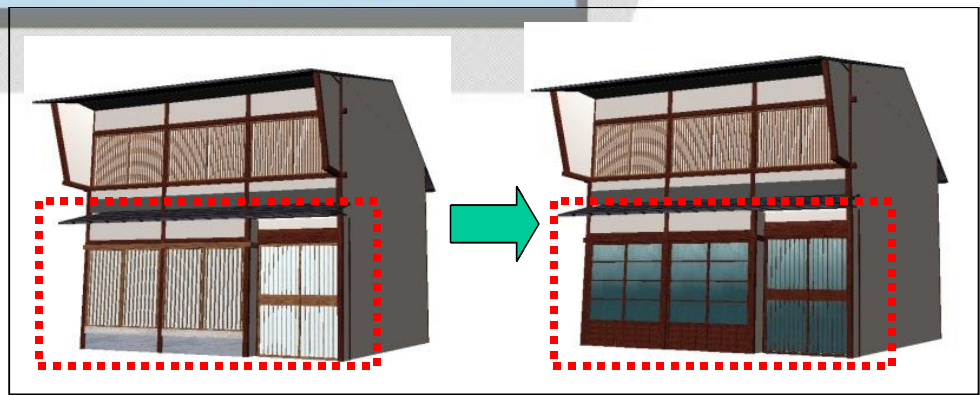
外観軸組み （フレーム）

＋

意匠要素 （パーツ）

＝

町家の表構え



Planning Learning

Researches 2001-2010 Learning tools for studying

- **Planning regulations**
- **Modified planning regulation**
- **Townscape design**

which are supports by JSPS,

Kanazawa City and Kanazawa NPO

Approach

Presentation for Planning and design

Planning learning

Planning & design proposal

Deliberation and Planning review

Cloud-based Virtual Reality and Planning support

Planning Learning

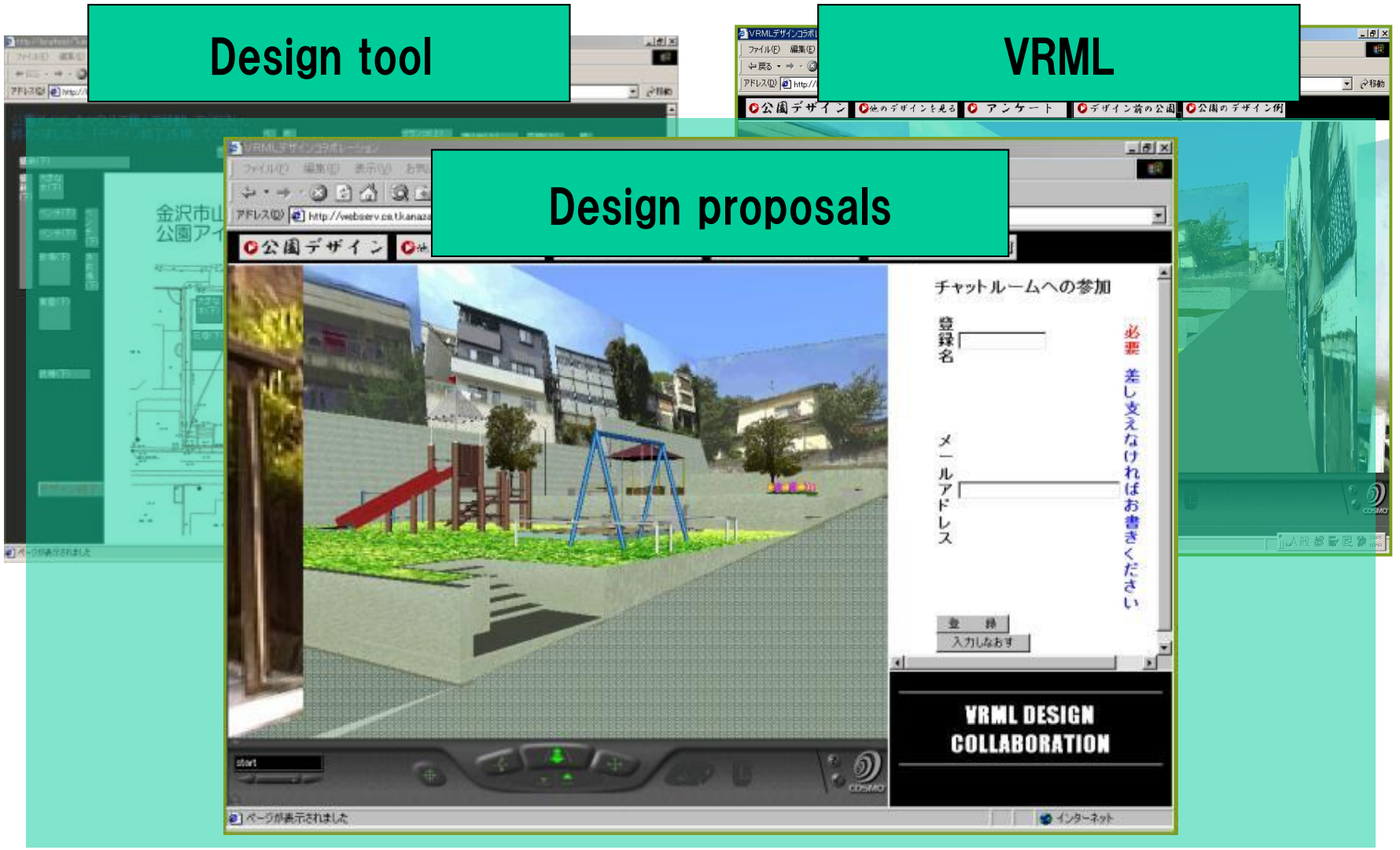
◆ **A design tool for making design proposal from residents**

(Kanazawa, 2001)

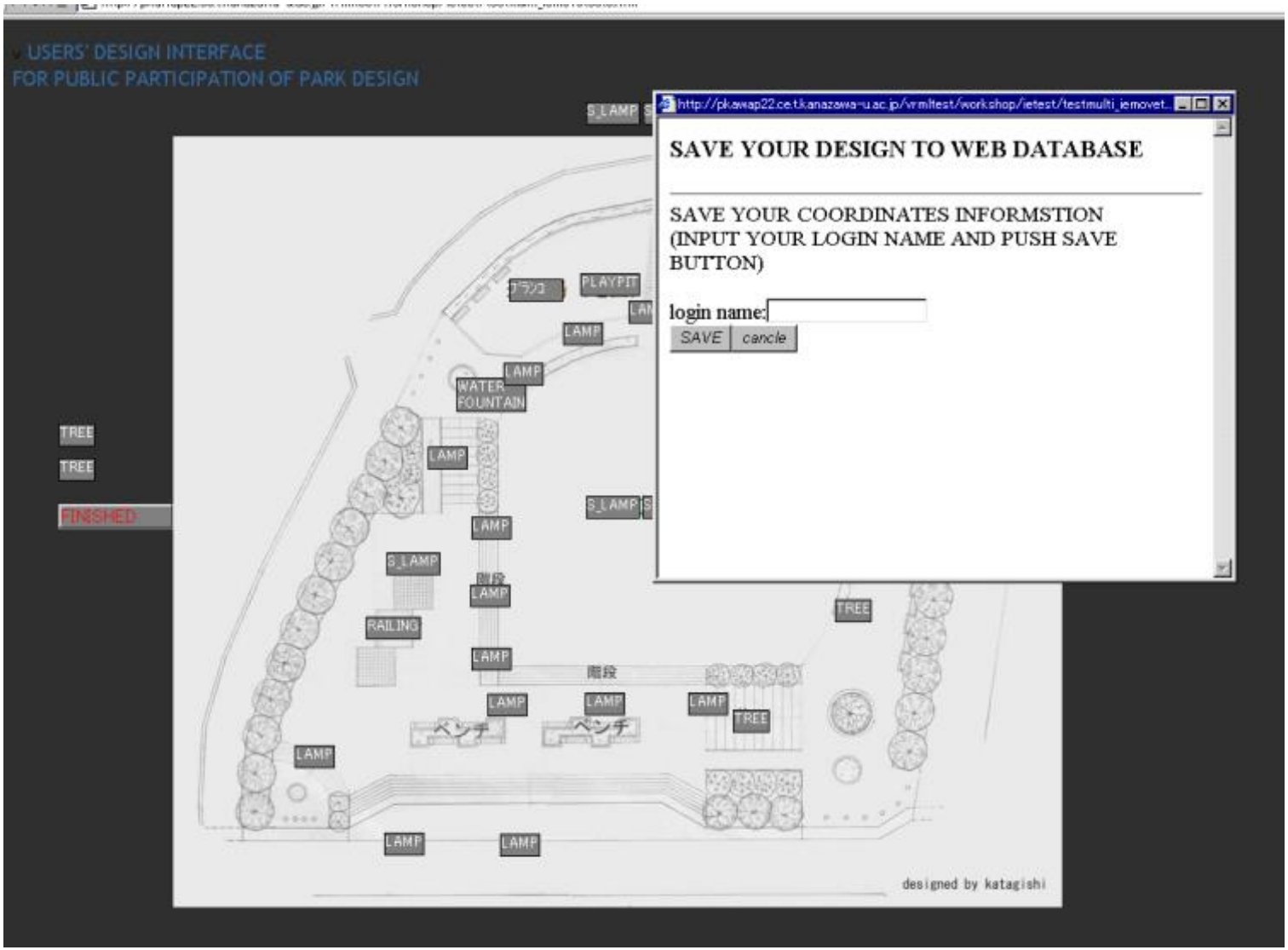
Conventional planning meetings

Planning Learning

◆A street park project（Kanazawa City, 2001）



ICON Game, Kanazawa city



Design Representation using VRML

Planning Learning

◆An elaborated design tool using 3Dvia in Urban Space (KULab, 2011)

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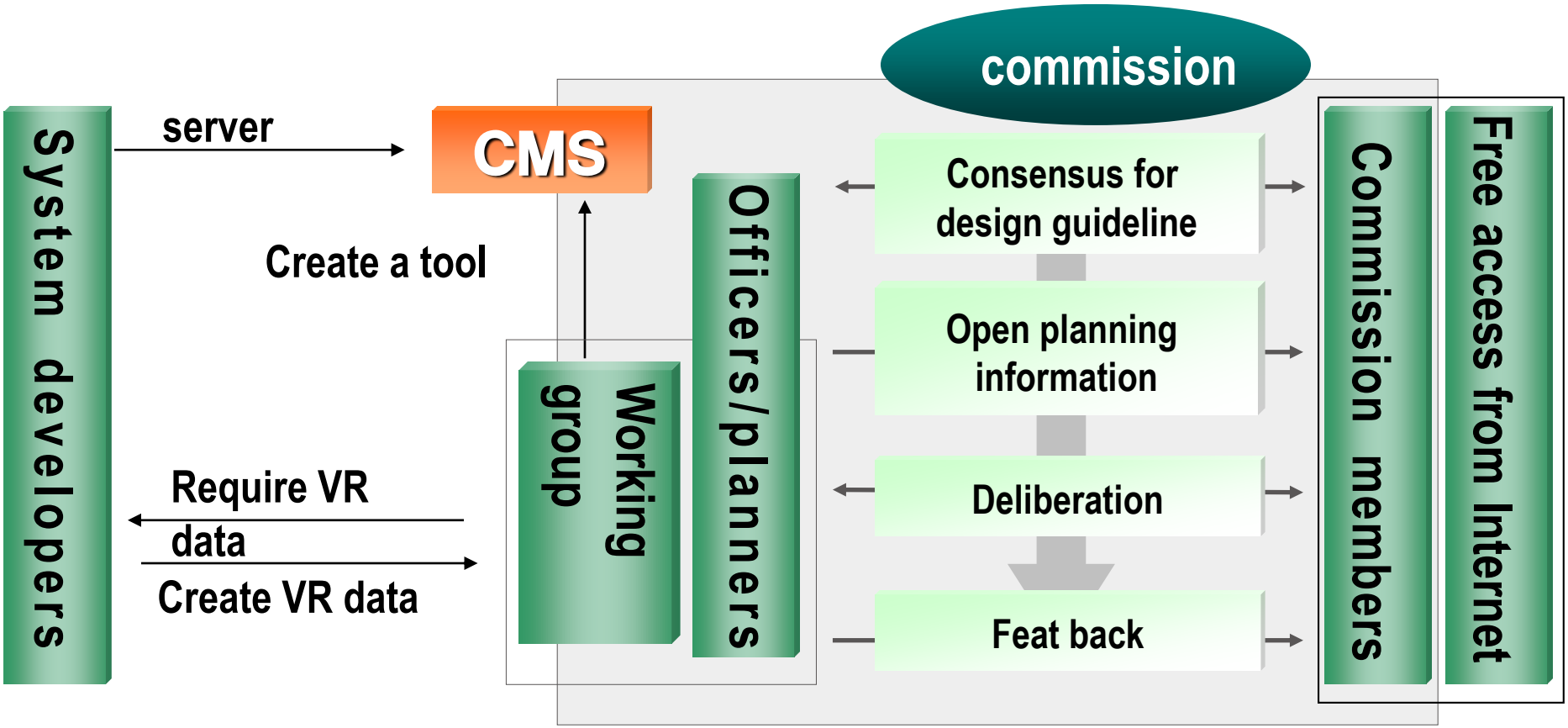
Deliberation and Planning review



The working group of a committee can create a visualization tool with the help of system operators.

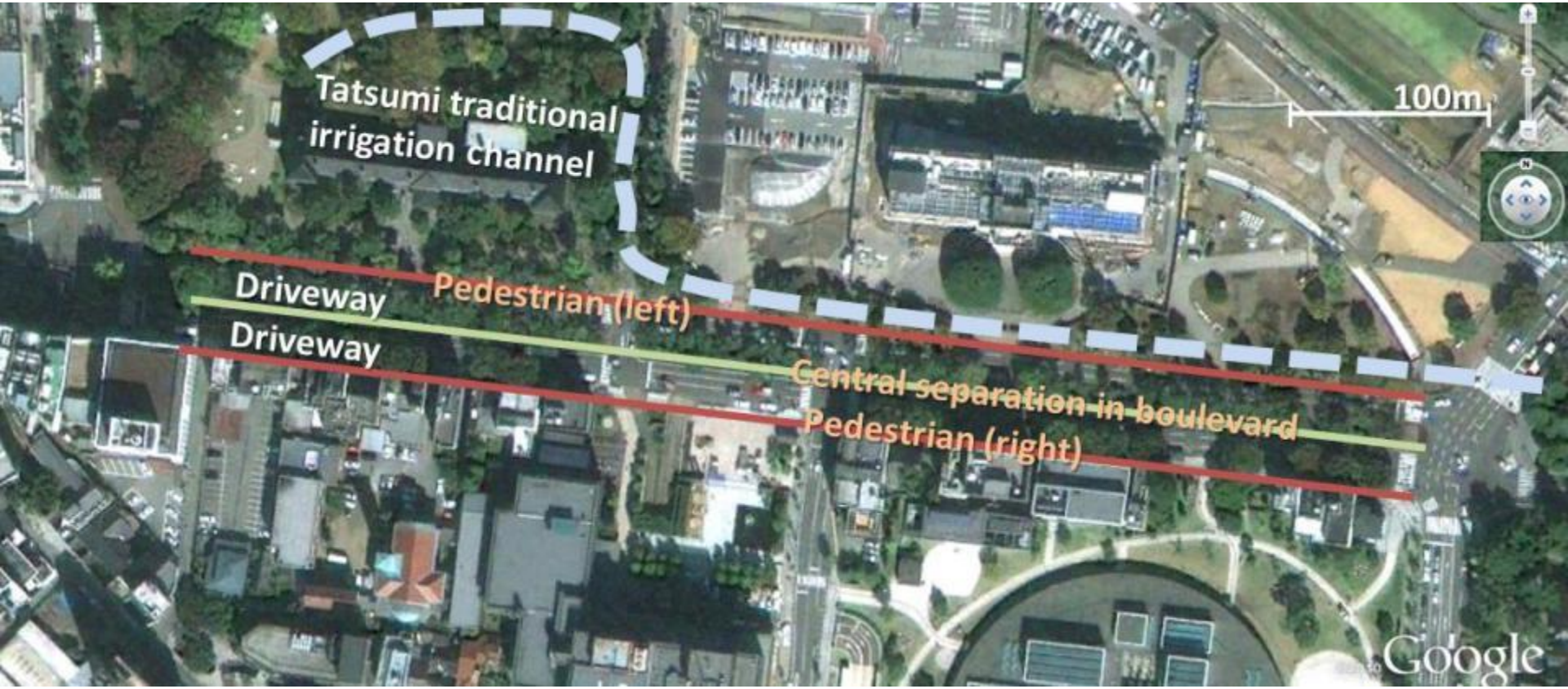
Deliberation and Planning review

Access from a meeting

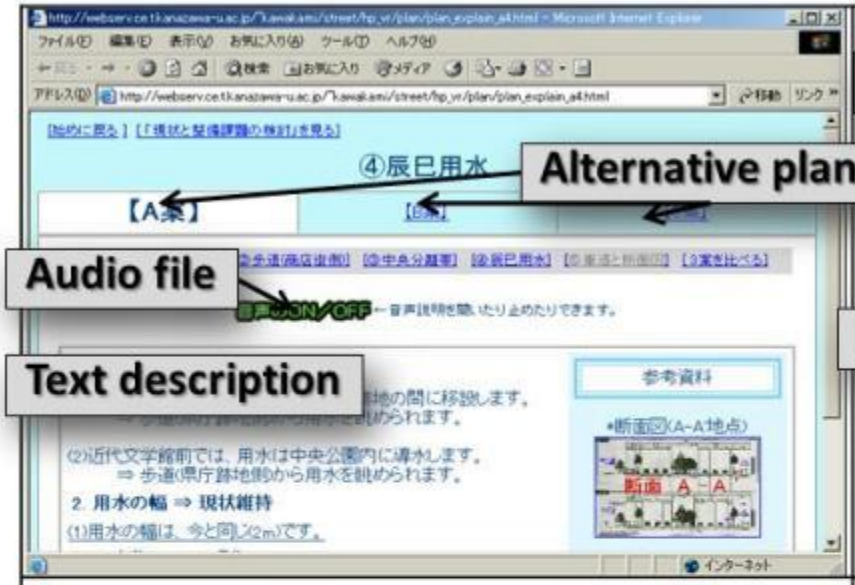
Access from home

Access from public facilities

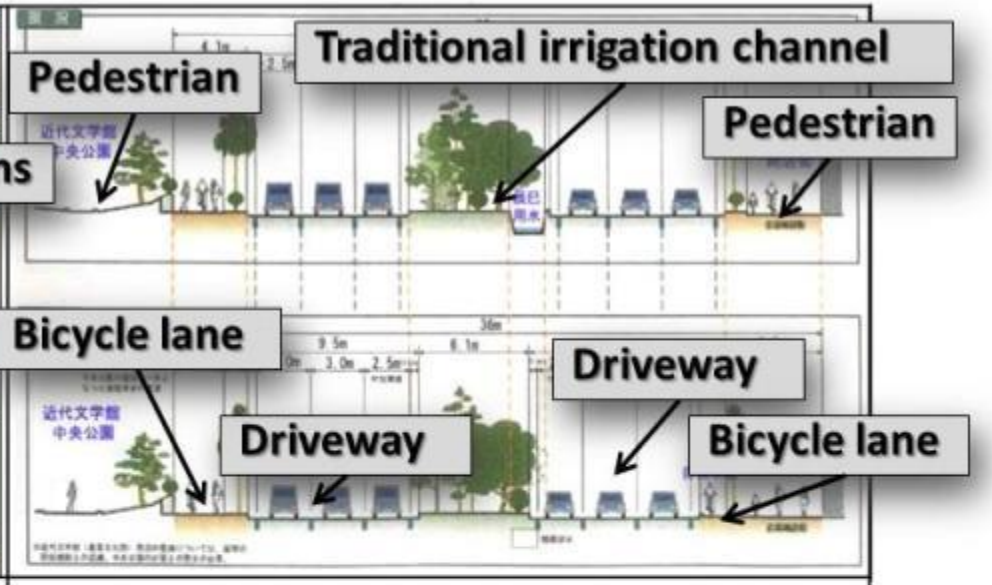
◆A Design meeting System for deliberation (Ishikawa, 2002)



Deliberation and Planning review



(a) Text and audio descriptions



(b) Planning drawings (road section)

(c) Planning drawings (pedestrian and bicycle lane)

(d) The plan represented by VRML

Deliberation and Planning review

Deliberation and Planning review

◆A Design meeting system for townscape design guideline (Ishikawa, 2004)

Location

symbol street in Nanao City

project

urban Renaissance project of Nanao City

Plan

widening of road、

building reconstruction

readjustment of lots

Committee

Residents：10　　experts：4

planners and officers ：8

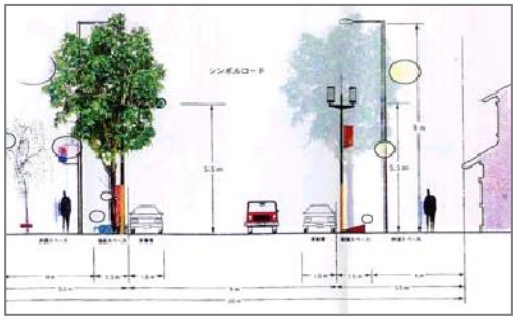
Facilitator：1

Project site

Deliberation and Planning review

SIMULATION DEISGN GUIDELINE OF TOWNSCAPE DESIGN PROJECT

Cross-sectional composition of street	Design of street furniture	Design of buildings
Position and width of driveways, sidewalk and etc.	Roadside trees, tree planting pot and others in sidewalk.	Architectural style and other accessories of buildings.



Exchanging planning alternatives dynamically in real time

Exchanging alternatives using VR

- Street furniture
- Land use
- design of buildings
- FAR limitation of buildings

For gaining consensus
Of design guideline

図2 カツラ (秋) の場合

The VR background is kept unchanging

Only the items for deliberation will be replaced

(A case study in NANAO city)

Deliberation and Planning review

Examination of the simulated scenes about the land use

(a) Supposed houses in each site

(b) Supposed building in larger site

Examination of others such as gate, fence, etc.,

(a) No gate exist

(b) Installation of gates

Examination of the simulated scenes about roadside trees

(a) Japanese Judas tree (Spring)

(b) Japanese Judas tree (Autumn)

(c) Chestnut (Spring)

(d) Chestnut (Autumn)

Deliberation and Planning review

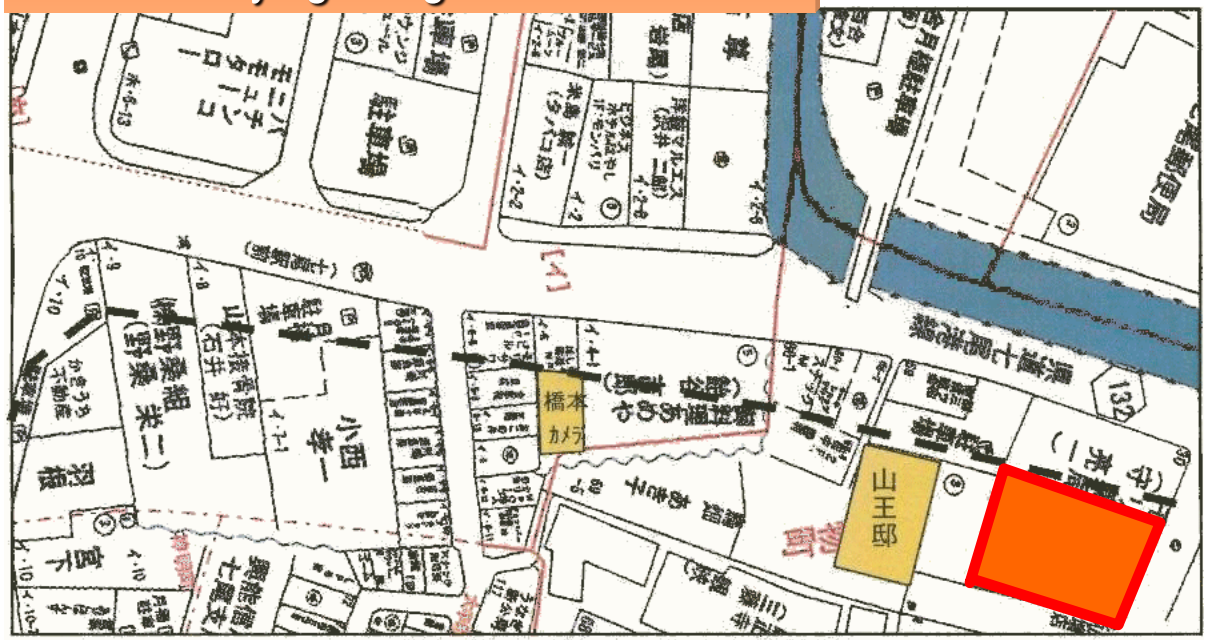
Design review codes (Authorization of local planning committee is necessary before construction)			Necessity	Consideration in design
A	A1	Roof shape 1)Sloping roofs of an angle around 4.5 in 10.	Yes	
		2)Parallel to the road	Yes	
		Front façade 1)Traditional painting and traditonal windows design		Yes
		2)Natural materials (wood and brick)		Yes
	A2	Color of exterior wall 1)Harmony with the colors of natural materials		Yes
		2)The brown, beige color or white and black design if no using of natural materials	Yes	
		3)Only black using for roofs	Yes	
B	B1	Green spaces		Yes
	B2	Shopping store in the 1st floor		Yes
		Show windows facing to the road		Yes
		Easy for tenants to open stores if owners do not open stores	Yes	
		No adult entertainment shop	Yes	
	B3	Advertisement considering townscape 1)No other advertisement beside owners' advertisement	Yes	
		2)Advertisements stand under the eaves	Yes	
		3)Design for covering air condition and other machines	Yes	
		4)No parking spaces occupying pedestrians road	Yes	

- The design guideline regarding private buildings Even though we can visualize them, the residents are offensive with the alternatives open to public.
- For gaining consensus, some movies or pictures are shown, but no visualization of each private building is conducted for townscape.

Deliberation and Planning review

◆A Design Review tool for design review meeting (Nanao, 2006)

A case studying using visualization tool



今年度対象だった３物件の位置図

Mori drug store （2006.6.26～2006.7.20）

Design review meeting for private building (VR+BLOG+CHAT+BBS)

Deliberation and Planning review

The interface of the tool

Deliberation and Planning review

Problems solved for free access on the WEB

1) Shared common image between participant
2) Comments and free discussions using BBS or chat and blog comments.

For commission meeting

3) Change the design options in real time.

<u>However, it is still difficult for private properties in practice</u>

4) It is difficult for owners of private buildings to have open discussion about their private properties.

Planning Commission Meeting
(VR+BLOG+CHAT+BBS) – any new tools? 3Dvia? VRCloud? Google?

Discussion

As a case study

1)Visualization tool is useful to the design and planning of public space.

2)Even though the private information is difficult to be open to public, the design review process for their building reconstruction is available to check whether the design is match with design guideline or not.

3)After design review of each reconstruction can be open on the Internet for all residents in project areas.

4)It is useful to organize the information technology to a PSS tool according to different requirements from different urban projects through analysis of their planning process in practice.

Future work and cloud-computing

Presentation for Planning and design

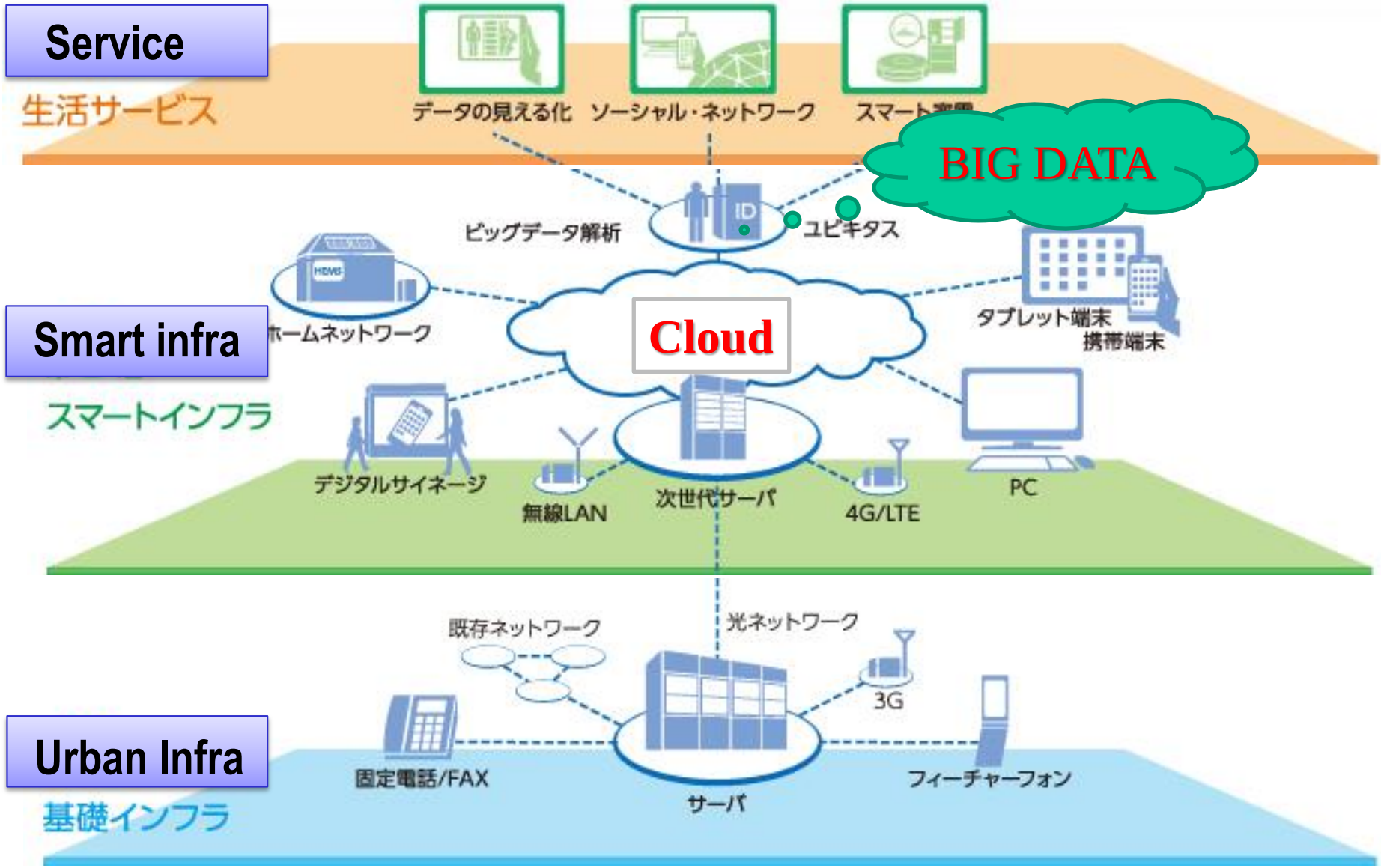
Planning learning

Planning & design proposal

Deliberation and Planning review

Cloud-based Virtual Reality and Planning support

Cloud-based Virtual Reality and Planning support



Cloud-based Virtual Reality and Planning support

◆BIG DATA in Urban Space

❖ Displaying a lifecycle that a person is born, grows up, gets married, gets old and passes away.

Be a baby

Grow up

Give birth

shopping

Working

Get married

Studing

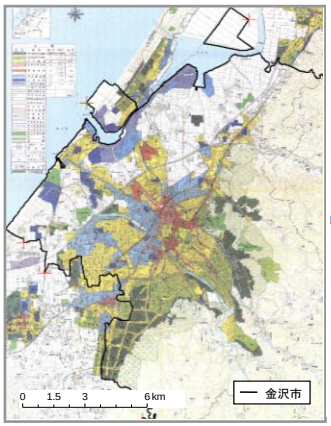
Get old

65 years old and over

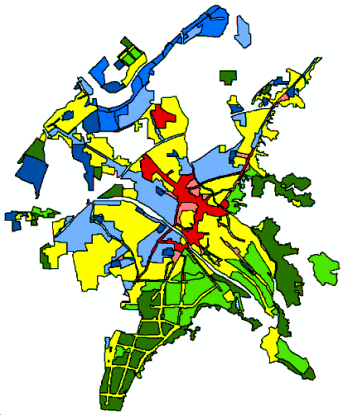
Pass away

Over 100 years old

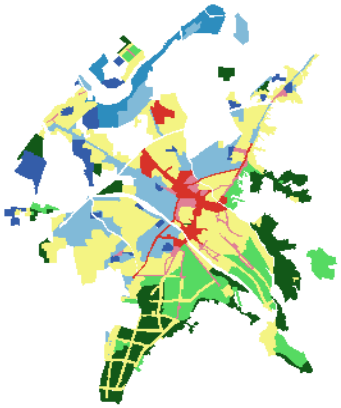
A Smart Planning Tool for Population and their housing location choices (Ishikawa, 2010-2013)



11a



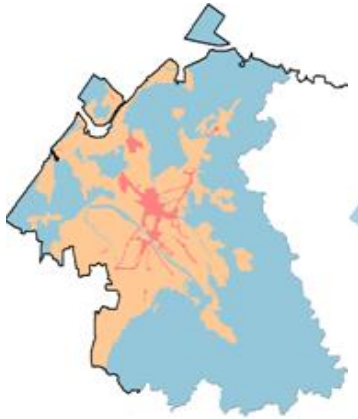
11b



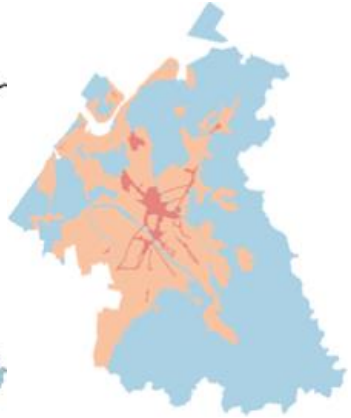
11c

1. Category I Exclusively residential zone
2. Category II Exclusively residential zone
3. Residential zone
4. Neighborhood commercial zone
5. Commercial zone
6. Quasi-industrial zone
7. Industrial zone
8. Exclusively industrial zone

Fig.11- Land use zoning in 1985.
a) paper map, b) Data in GIS, c) Data in Netlogo



12a

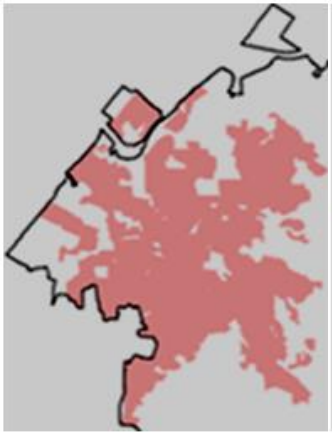


12b

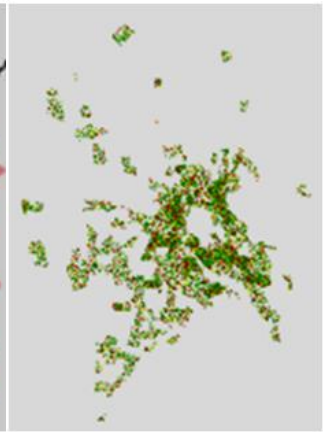
City Center Area (CCA)
Urbanization Promotion Area (UPA)
Urbanization Control Area (UCA)

Fig.12- Urban areas in 1985.
a) Data in GIS, b) Data in Netlogo

Fig.13- Household distribution.
a) Household distribution in Kanazawa City,
b) Distribution of 6825 households with 3 different kinds of income



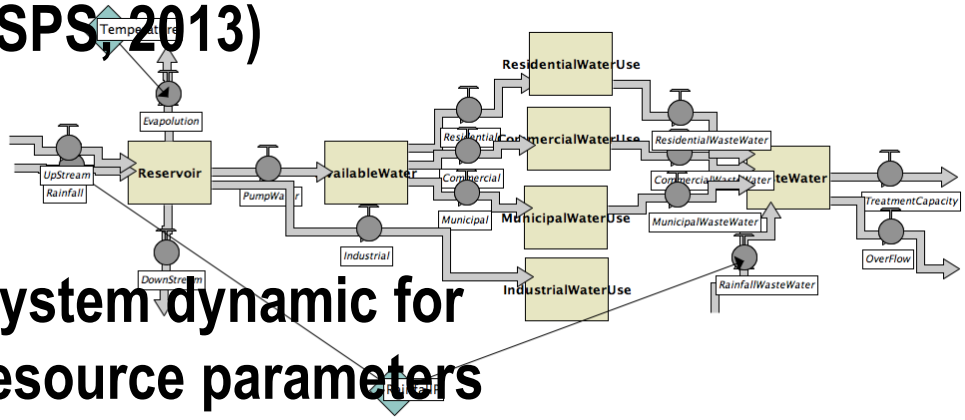
13a



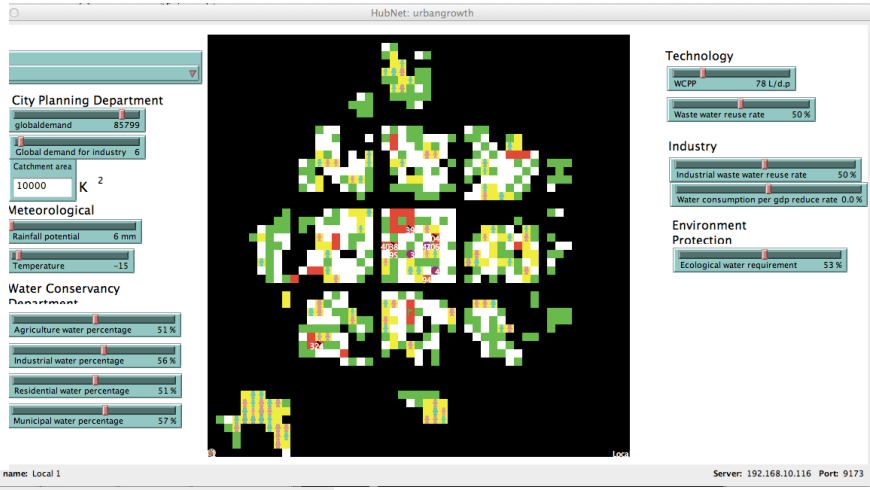
13b

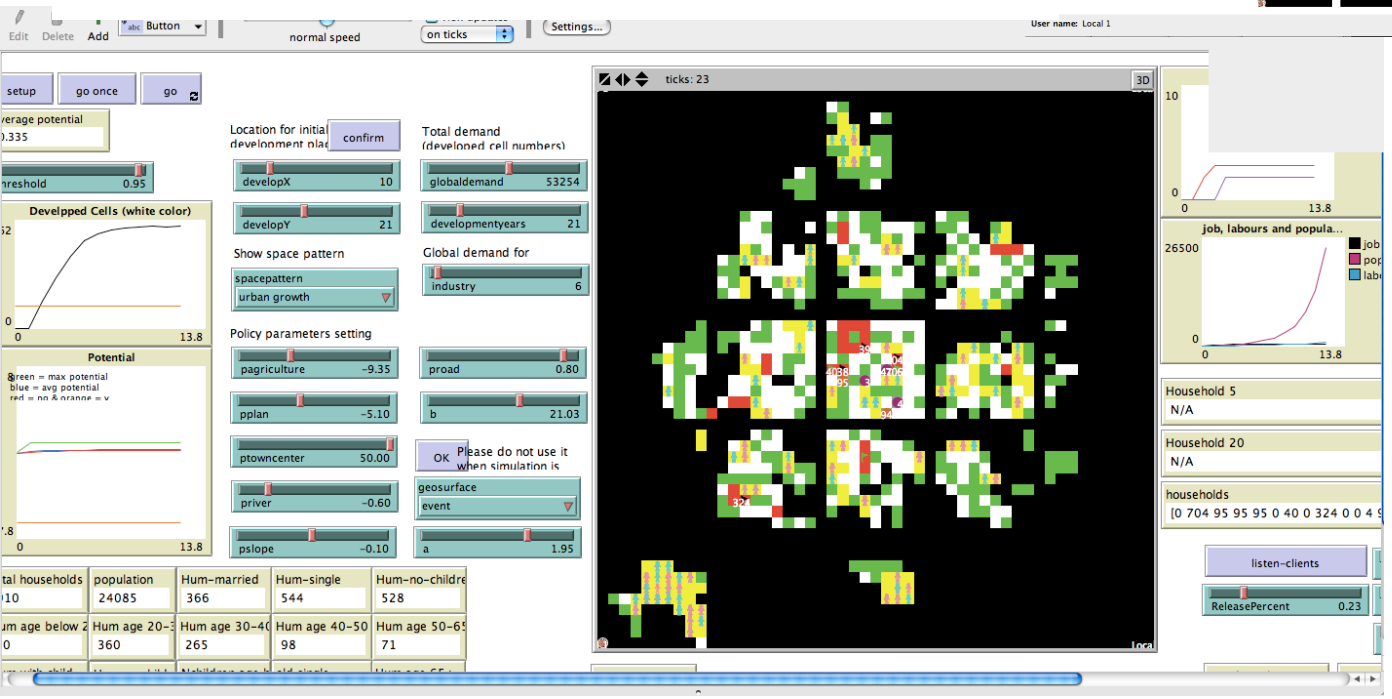
Cloud-based Virtual Reality and Planning

◆A Smart Planning tool for decision-making of urban growth policy (JSPS, 2013)



System dynamic for resource parameters



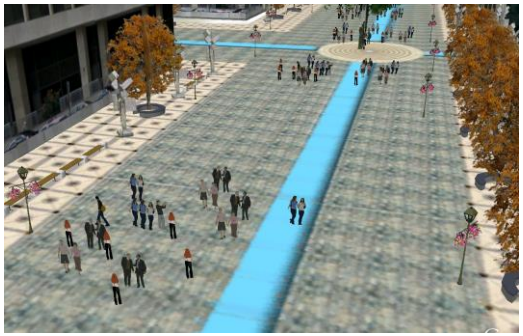


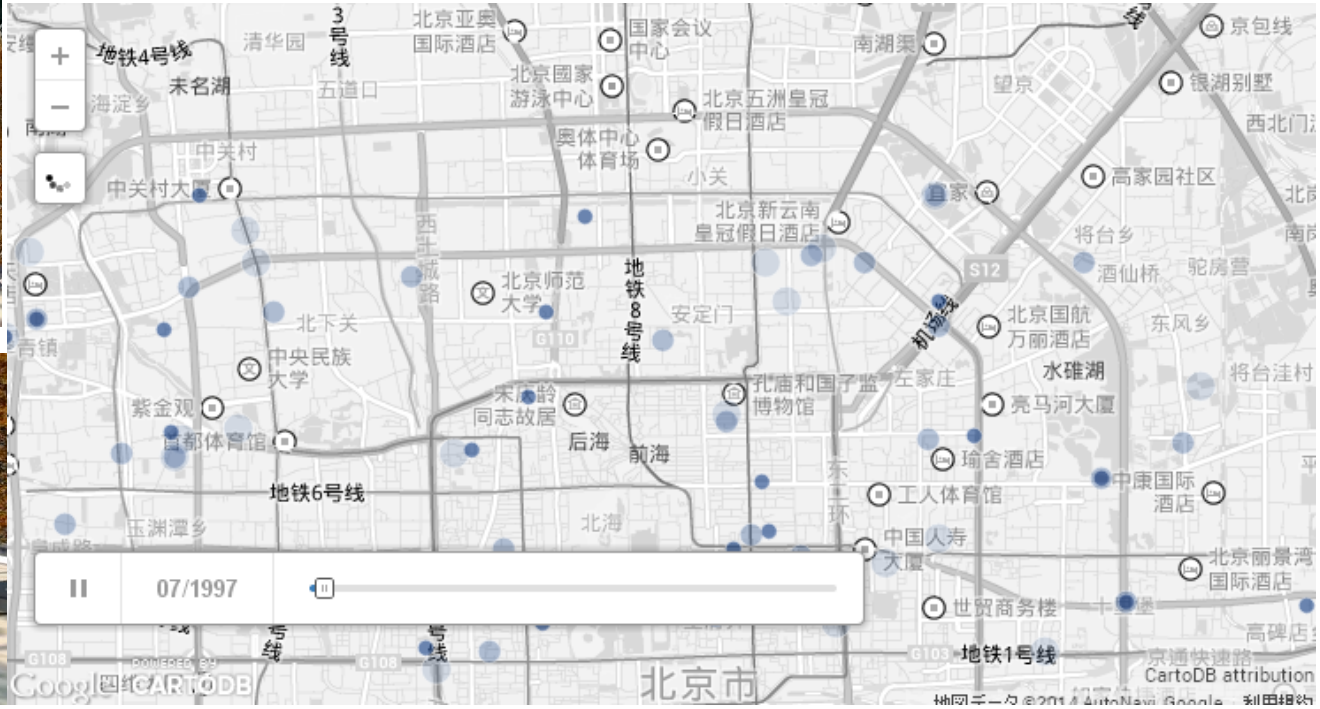
Client 1,2,3,… site (Policy maker)

Server site (Mayor)

Cloud-based Virtual Reality and Planning

◆BIG DATA for Urban Design of Public Space

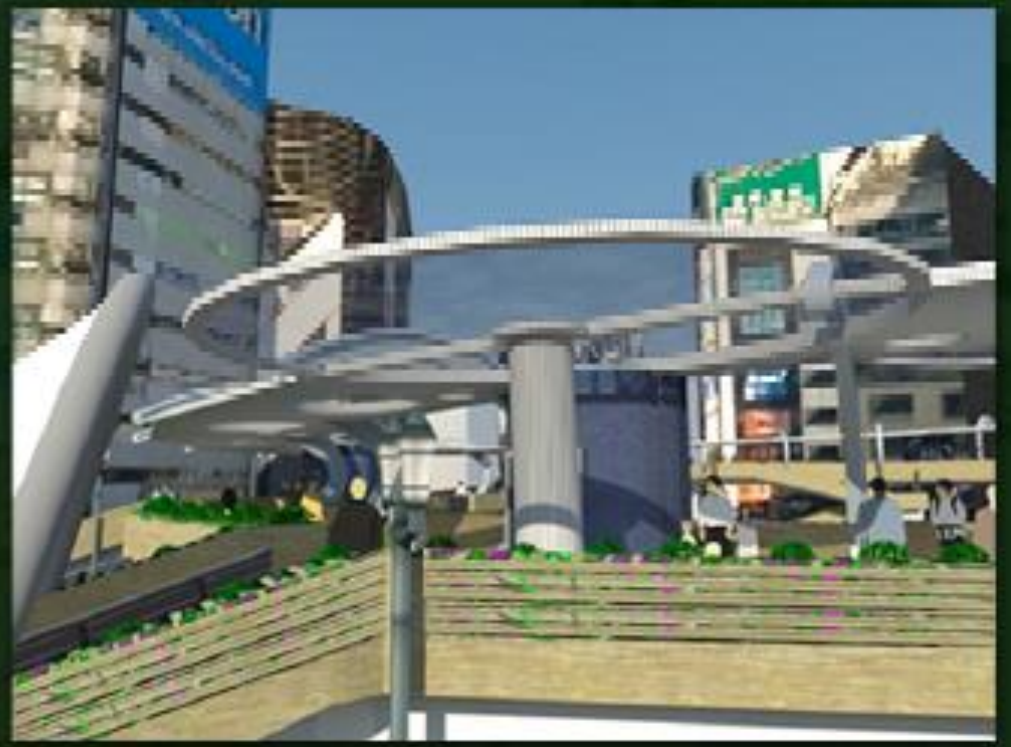




- How people move in urban space?
- Check-in data, cell phone with GPS, Traffic Card

Cloud-based Virtual Reality and Planning support

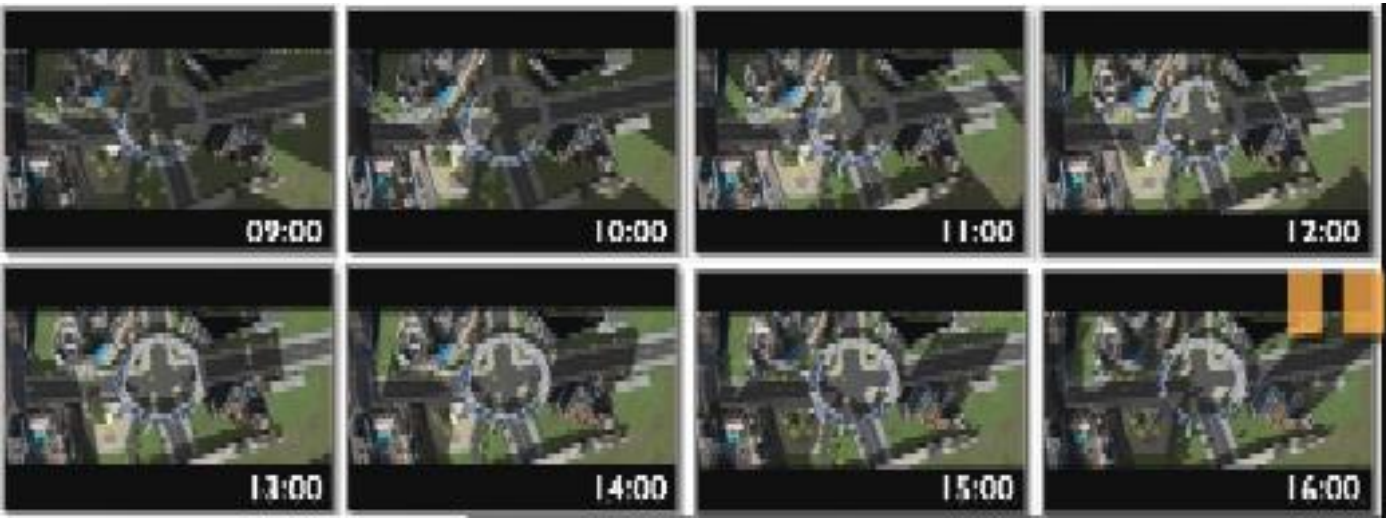
Virtual Design World Cup Award (Zhenhan, LEI in KU)

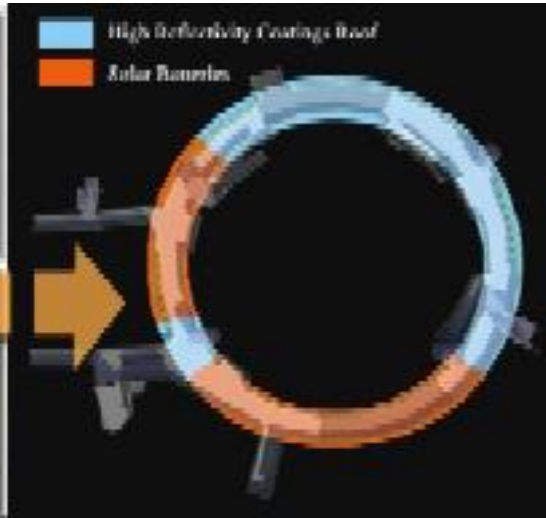


Cloud-based Virtual Reality and Planning

◆BIG DATA + VR Cloud is possible using the platform of Forum8

- Big data reflecting the tracks of people and car moving
- Input to UCWIN/Road
- Visualizing the car and people





Cloud-based Virtual Reality and Planning support

	VR Cloud (In KU)	Google Earth	3DVIA
Sever side			
VR Sever	Application server	Application	Http-based application server
Server management	Standalone (Specified IP address)	Cloud server	Cloud server
VR Database			
Dataset	KMZ created in SketchUp	KMZ created in SketchUp	KMZ created in SketchUp
VR objects	Prepared and imported	Prepared and imported Possible to use online data warehouse	Composed on-line using 3DVIA tool and possible to use online data warehouse
VR data editing	Impossible	Impossible	Direction, position and scale
Design alternatives	Prepared	Prepared	Possible for user to adjust
Data range	Planning site only	Global	Planning site only
Surrounding data	No	3D warehouse	3D warehouse

Cloud-based Virtual Reality and Planning support

	VR Cloud (In KU)	Google Earth	3DVIA
Functions of the VR server			
VR Navigation	Predefined and freely walkthrough	Freely walkthrough	Predefined and freely walkthrough
Communication	No (QQ)	No (QQ)	Chat
Avatars	Car and person can move based on predefined scenarios	No	Avatars on behalf of real users
Sound Environ.	Car noise	No	No
Total evaluation			
SaaS	VR representation and simulation.	VR representation	VR representation and communication with avatars
System Developer	Difficult	Easy	Easy
Planer	Comprehensive	Simple	Middle

Cloud-based Virtual Reality and Planning support

◆BIG DATA in the three platforms

	Volunteer Text	Movie	Photo	Person	Car
❖ Google Earth	Yes	Yes	Yes	No	No
❖ VR-Cloud	No	No	No	Yes	Yes
❖ 3DVia	No	No	No	No	No

❖ Google Earth can be social network for collecting multi media data as BIG DATA

❖ VR-Cloud is possible to import big data for VR simulation.

Cloud-based Virtual Reality and Planning support

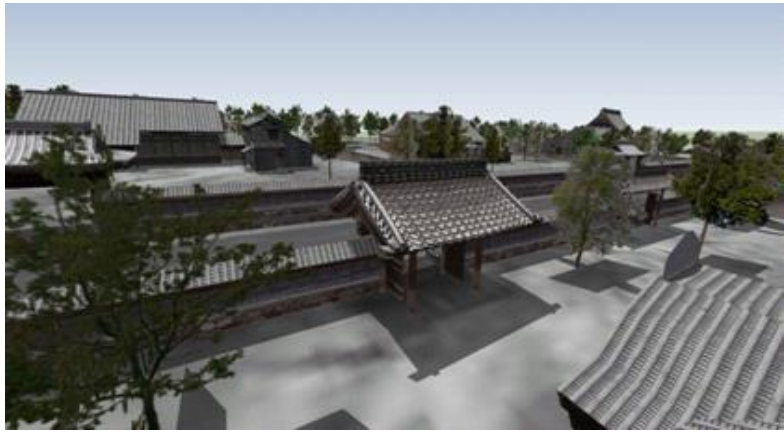
Planning support system in future

Traffic

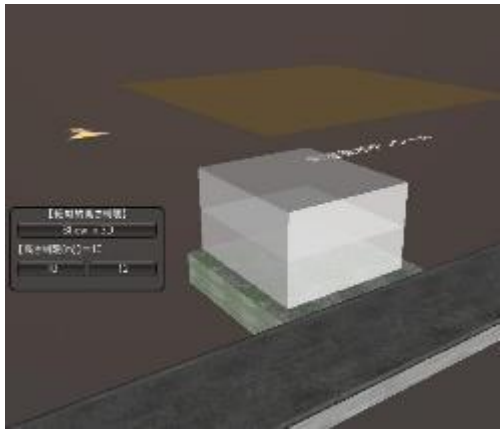
Land use

Policy-making + Planning + Design

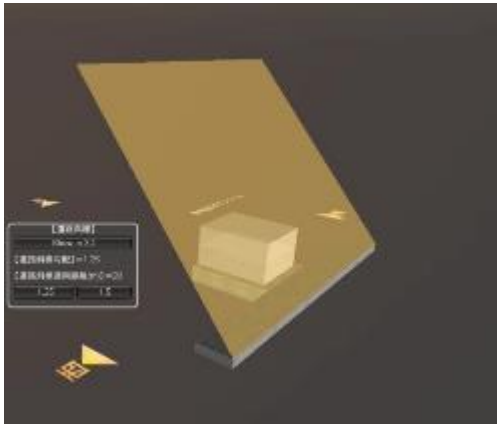
Urban design



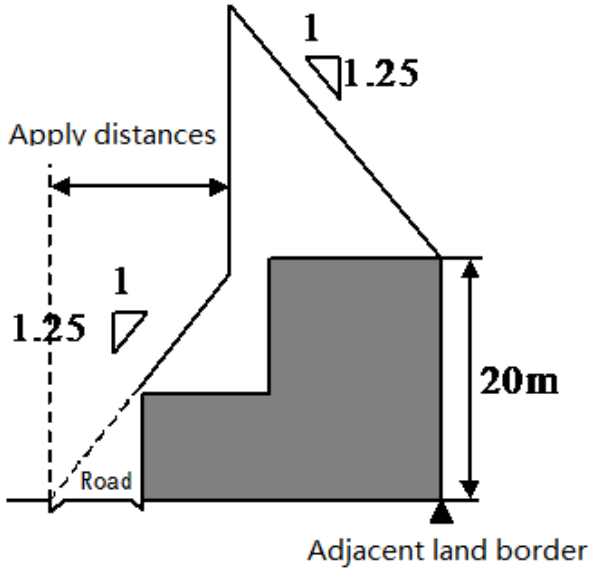
Buildable space based on planning regulations



Height Control



Slash Control



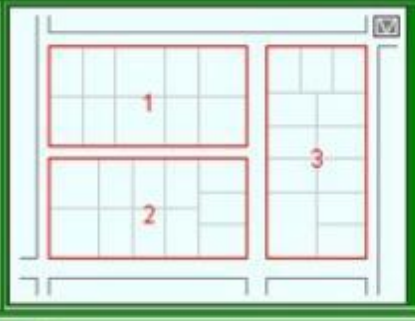
Morphology Control

Buildable space based on planning regulations

Image of the tool

あなたは
街区1について 第一種中高層住居専用地域
街区2について 第一種低層住居専用地域
街区3について 第二種中高層住居専用地域
を選択しました。

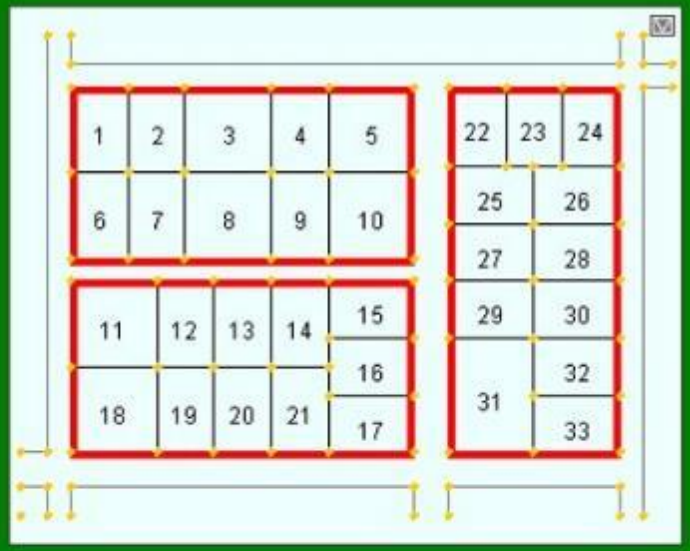
下で各街区の条件を入力し、次へ を押して下さい。 用途を選択し直す場合は こちら
この部分は選択可能⇒ 選択できます。 この部分は選択できません⇒ 規定されています。



街区1について	街区2について	街区3について
容積率／建蔽率 200/60	容積率(%)／建蔽率(%) 50/30	容積率／建蔽率 200/60
外壁の後退距離(m) 規制なし	外壁の後退距離(m) 0	外壁の後退距離(m) 規制なし
絶対高さ制限(m) 規制なし	絶対高さ制限(m) 10	絶対高さ制限(m) 規制なし
道路斜線適用距離(m) 20	道路斜線適用距離(m) 20	道路斜線適用距離(m) 20
道路斜線勾配 1.25	道路斜線勾配 1.25	道路斜線勾配 1.25
隣地斜線立ち上がり(m) 20	隣地斜線立ち上がり(m) 規制なし	隣地斜線立ち上がり(m) 20
隣地斜線勾配 1.25	隣地斜線勾配 規制なし	隣地斜線勾配 1.25
北側斜線立ち上がり(m) 10	北側斜線立ち上がり(m) 5	北側斜線立ち上がり(m) 10
北側斜線勾配 1.25	北側斜線勾配 1.25	北側斜線勾配 1.25

Buildable space based on planning regulations

Image of the tool



地図の縮尺変更

全体表示 | 拡大 | 縮小

地図の表示切替		その他切り替え
☑ 街区ポリゴン	□	☐ 街区番号　番号＝1
☑ 敷地ポリゴン	□	☑ 敷地番号　番号＝1 ☐ 角地　角地＝
☑ 道路ライン	—	
☑ 街区ポイント	・	

クリックした敷地の属性情報を表示します↓↓↓
(※ただし、敷地ポリゴンの表示時のみ！)

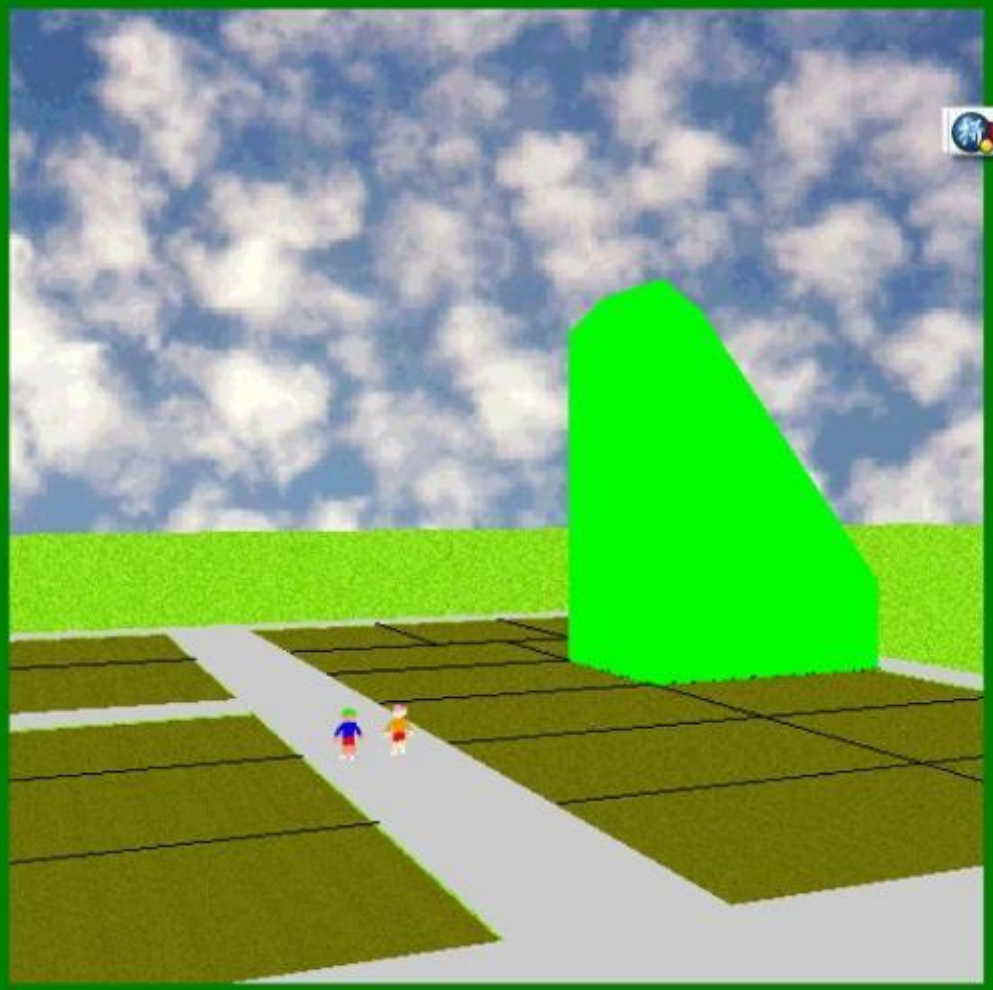
敷地番号		1	敷地面積	150(㎡)	北側道路？	4m道路	隣地立上がり高さ	20(m)
(X3,Y3) (X2,Y2) (X0,Y0) (X1,Y1)	(X0,Y0)	(9,60)	絶対高さ	規制なし(m)	東側道路？	道路なし	隣地斜線勾配	1.25(m)
	(X1,Y1)	(19,60)	容積率	200(%)	南側道路？	道路なし	北側立上がり高さ	10(m)
	(X2,Y2)	(19,75)	建蔽率	60(%)	西側道路？	4m道路	北側斜線勾配	1.25
	(X3,Y3)	(9,75)	角地？	角地	道路斜線適用限界距離	20(m)		
用途地域		第一種中高層住居専用地域	壁面後退距離	規制なし(m)	道路斜線勾配	1.25	建築利用可能空間	表示

Buildable space based on planning regulations

Image of the tool

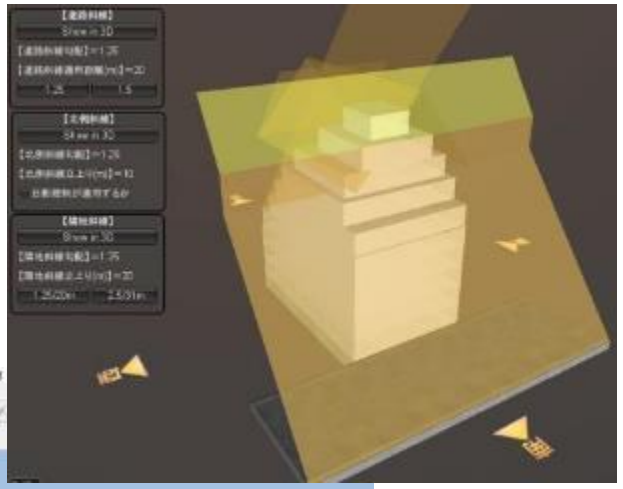
建築利用可能空間の3次元表示

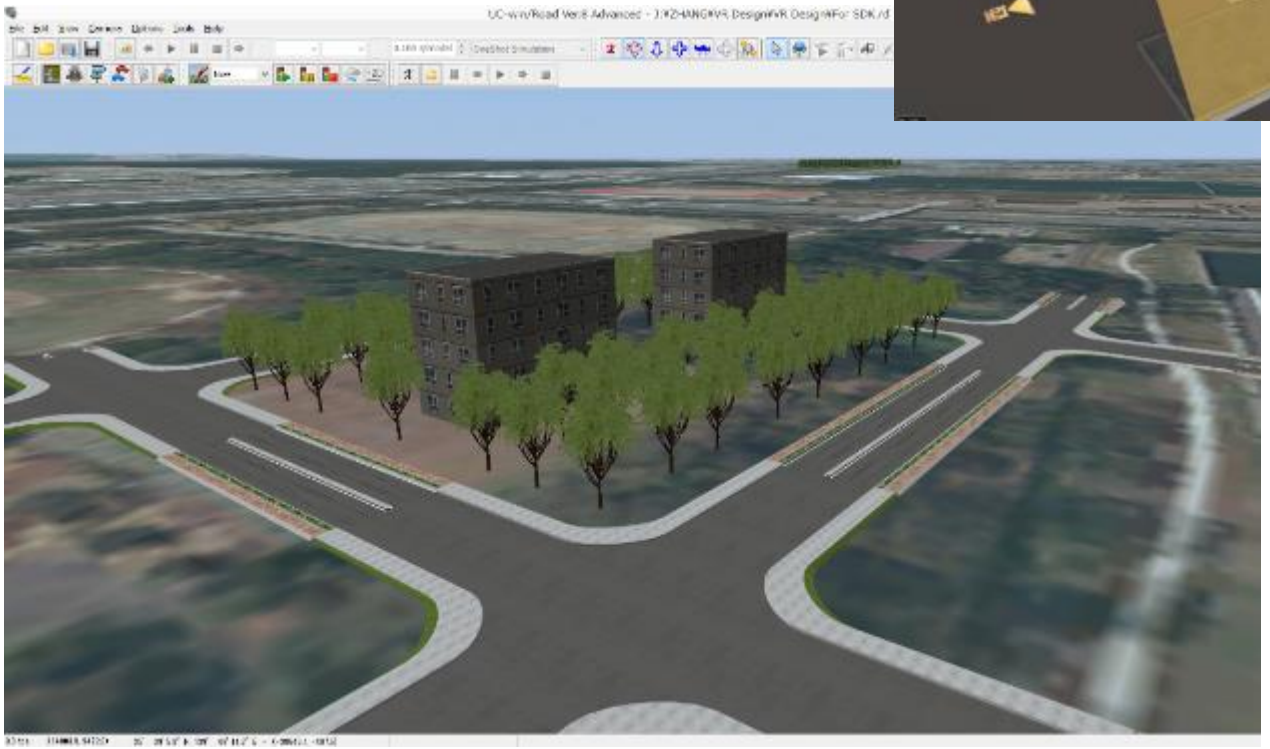
あなたが選択した敷地と設定条件	
敷地番号	28
敷地座標(X,Y) (90,51) (105,51) (90,41) (105,41)	間口X＝10 奥行Y＝15 敷地面積(m²)＝150 絶対高さ(m)＝規制なし
隣接道路 (北道) (西道) (東道) (南道)	(北側道路)=(道路なし) (西側道路)=(道路なし) (東側道路)=(4m道路) (南側道路)=(道路なし)
道路斜線	勾配:1.25 適用距離(m):20
隣地斜線	勾配:1.25 立上り高さ(m):20
用途地域	第一種住居地域
視点の移動(空間を)	○南→北 ○北→南 ○西→東 ○東→西
◉最初の視点位置へ	
○ワイヤー表示 ◉ポリゴン表示	表示を更新

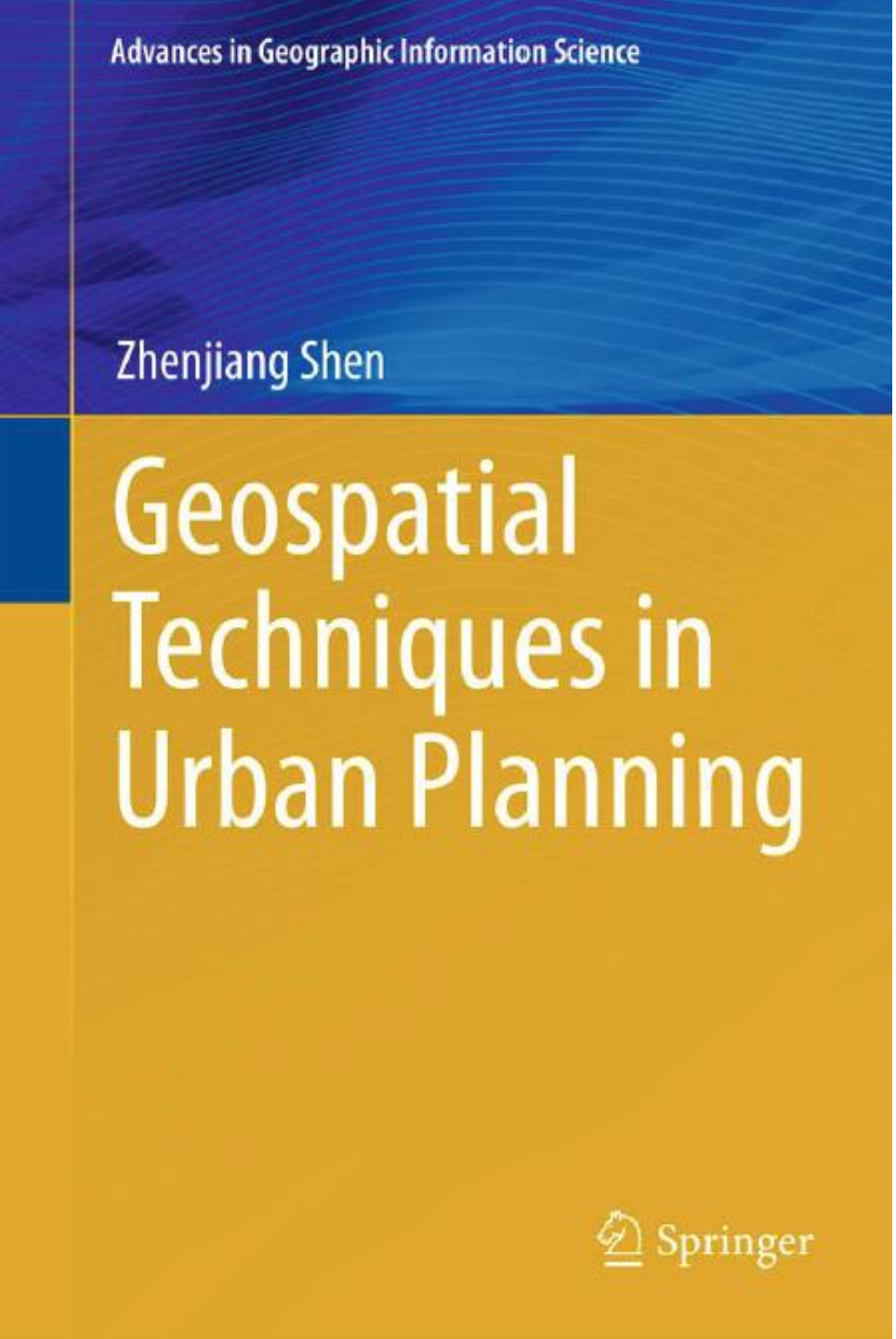


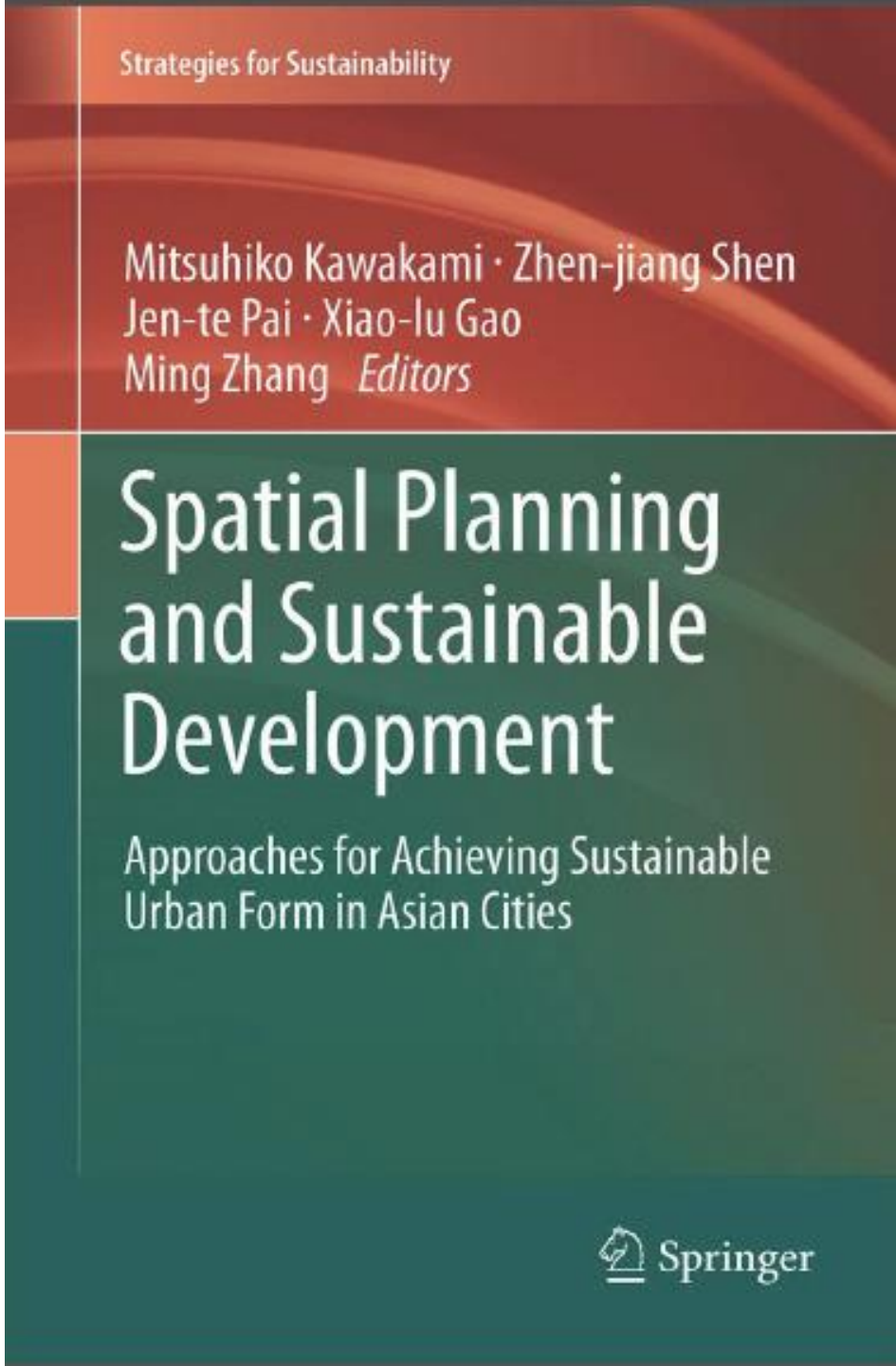
Buildable space based on planning regulations

Image of the tool






Advances in Geographic Information Science
Zhenjiang Shen
Geospatial Techniques in Urban Planning
Springer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Mitsuhiko Kawakami · Zhen-jiang Shen
Jen-te Pai · Xiao-lu Gao
Ming Zhang Editors
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Approaches for Achieving Sustainable Urban Form in Asian Cities
Springer

Thank you for your attention