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The Possibility of BRO Works in the City of Malang: an Idea and an Analysis

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ABSTRACT

This paper is concerned with an inclusive, vibrant and convivial street environment in the city center. There are some problems in the city center such as full crowded, full of skyscrapers, air and noise pollutions, daily traffic jams, and unhealthy place to live-in especially for children and elderly people. Every morning and evening rush hours cities become packed with vehicles. This study investigates this problem by combining qualitative and quantitative methods with three steps: Selection of appropriate sites to be included in the operational assessment; Collection of observational data of pedestrian and driver behavior; and Statistical analysis of the data. The new design created using 3D. The objective of this research is to examine the possibility of BRO works, and the main purpose is to stimulate economic activity through increased pedestrian activity when it is really implemented. This study shows that the design of BRO can be apply in the city center of Malang to reduce vehicles speed and it makes comfortable for pedestrians, calm and clean, easy to move by public transport, kind to children and elderly people, easy to cooperate with citizens and visitors.

Keywords: Design, Links, BRO, City-center, Pedestrian

INTRODUCTION

Streets are complicated place because they must serve a variety of functions, particularly those related to the movement and traffic circulation, interactions, exchanges, and other social and community activities. Streets are not only complicated. They are also immensely important. In Europe, and even more in the USA, streets represent perhaps 80% of the public realm of the urban environment [1]. Streets have five principle functions: place, movement, access, parking, and drainage, utilities and street lighting [2]. These functions are derived from *Paving* the *Way* [3]. Street design should be inclusive. Inclusive design means providing for all people regardless of age or ability. There is a general duty for public authorities to promote equality under the Disability Discrimination Act 2005 [4]. Designers should refer to *Inclusive Mobility*, *The Principles of Inclusive Design*, and *Guidance on the Use of Tactile Paving Surfaces* in order to ensure that their designs are inclusive [5,6,7]. The specific conditions in a street will determine what form of crossing is most relevant. All crossings should be provided with tactile paving. Further advice on the assessment and design of pedestrian crossings is contained in Local Transport Notes 1/95 and 2/95 and the *Puffin Good Practice Guide* [8,9,10]. Related to the LOS of the road, there is a relationship between land use changes and the LOS of the road [11].

City centre is an important area in the City because many people come to work in the city centre. It consists of stores, government building, banks, and cultural attractions. There are some problems in the city centre such as full crowded, full of skyscrapers, air and river pollutions, daily traffic jams, and unhealthy place to live-in especially for children and elderly people. Every morning and evening rush hours cities become packed with vehicles. If city centre can not grow anymore and it also so many problems, citizenry will be move to the rural-urban fringe because this area is not so far from city centre and it has many positive advantages compare with city centre [12]. Related to this condition, here are two solutions: firstly, we create an appropriate strategy for rural-urban fringe area [12,13]. Secondly, we create BRO design to improve the design of existing in city centre. The design of BRO in this research adopted TDO concept by Kubota [14]. It is a little different because this research combines shared-space concept and TDO concept. This research investigates city centre's problem using combination qualitative and quantitative methods with three steps: Selection of appropriate sites to be included in the operational assessment; Collection of observational data of pedestrian and driver behaviour; and Statistical analysis of the data.

The objective of this research is to examine the possibility of BRO works, and the main purpose is to stimulate economic activity through increased pedestrian activity when it is really implemented. Firstly we discuss about the definition of BRO (Berbagi Ruang Omotenashi). Secondly, we identify an appropriate location for the application of BRO. Thirdly, we create a new design to manage traffic speeds and improve the pedestrian experience by narrowing the carriageway, using tighter geometry, de-cluttering the street, providing street

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seating etc. Then, the outcome of this research can be used by city government to creating a new design of street for the sustainability and liveability of the city centre in the future.

MATERIALS AND METHODS

In this research, we used combination between qualitative and quantitative methods with three steps: Selection of appropriate sites to be included in the operational assessment; Collection of observational data of pedestrian and driver behavior; and Statistical analysis of the data. The new design created using 3D.

Three sites and 26 links were selected based on site visits and site maps (which detailed the street layout and key characteristics). Firstly we make photo analysis to identify characteristic of each sites and links in two categories: no activity and full activity. Secondly, we make a cross-section of each links in accordance with the existing condition in two categories: no activity and full activity. Thirdly, we mapped public transportation routes in accordance with the existing condition that passes through the study area. Then, we try to improve the existing design with the new design of street, more livable for pedestrian in the city center. The research design can be seen in Fig. 1.

The location of the study is the city center of Malang City, East Java, Indonesia. The present study selected Klojen Sub-district and three sites, which have a total area of about 8.83 Km^2. In 2012, there were 106,017 inhabitants and population density is 12,006 inhabitants/km^2 (Statistic of Malang City, 2012). The study area located between 112.06° - 112.07° (East longitude) and 7.06° to 8.02° (South latitude). The study area has a topography that is most flat (96.3 per cent) with slope 0 per cent to 15 per cent and a height of 380 meters to 667 meters above sea level. Detail of the location of three sites can be seen in Fig. 2.

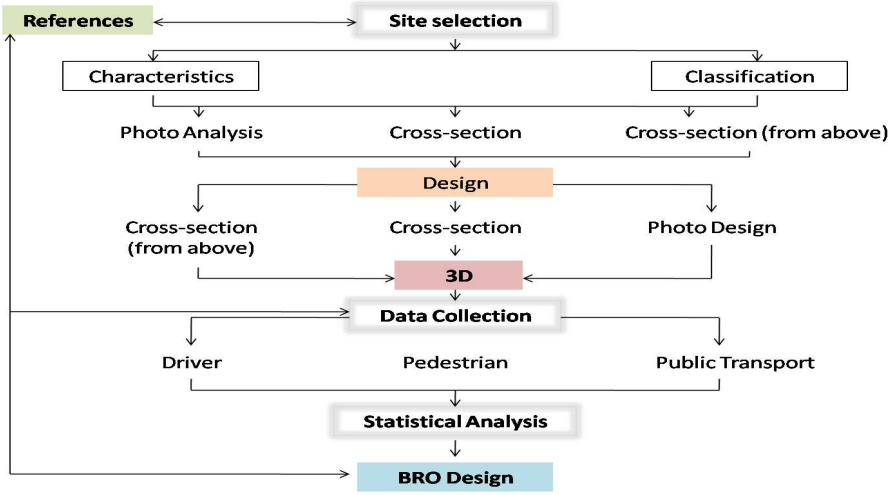

Fig. 1 Research design

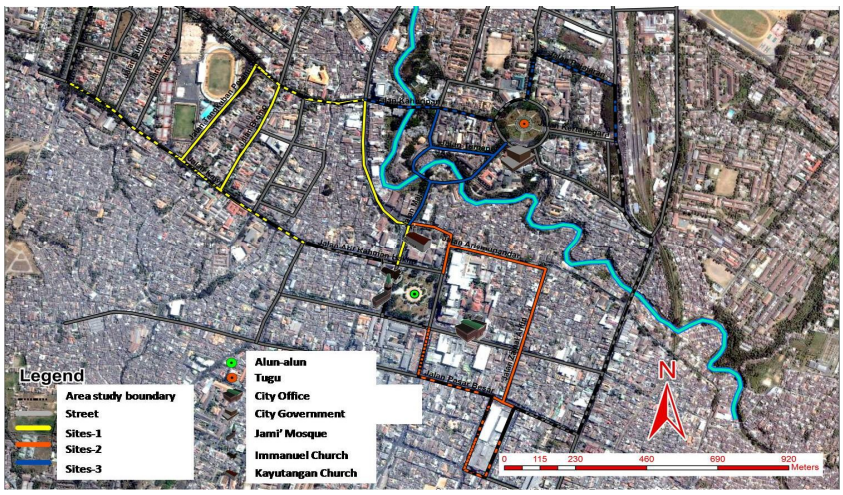

Fig. 2 The location of BRO design

RESULTS AND DISCUSSION

Characteristic of Streets

Analysis of the characteristics of the street evaluate patterns and conditions of the road network, in which road network is an infrastructure that has an important role in the region, and the street as well as the access link from one place to another. Various analysis were conducted to determine how important the function of the street to support the accessibility and mobility of a human activity. Here is the analysis of the condition of the road network in three sites (Alun-Alun, MOG, and Tugu) in the city centre of Malang City, East Java, Indonesia (Table 1).

Table 1 Characteristic of streets in the study area

Sites	Links	Characteristics	Analysis
Alun-alun			
	Jl. SW. Pranoto	- hierarchy of the street is secondary collector - total of street reserve is 7.5m - the users are pedestrian, vehicle, motorcycle, and on street parking - there is no complementary street	Based on the hierarchy of the street and street users, there is needed a plan to 'street design' for users in the area of Alun-alun, so that it can be create a comfortable community. Street design conducted by observing road users and the types of activities that are in the area of Alun-alun.
	Jl. Arismunandar	- hierarchy of the street is secondary collector - total of street reserve is 10.5m - the users are pedestrian, vehicle, motorcycle, and on street parking - there are complementary street ie traffic signs	
	Jl. Pasar Besar	- hierarchy of the street is secondary collector - total of street reserve is 10m	

Continued of Table 1

Sites	Links	Characteristics	Analysis
		- the users are pedestrian, vehicle, motorcycle, on street parking and some illegal activities - there are only a few complementary street ie street signs	Based on the hierarchy of the street and street users, there is needed a plan to 'street design' for users in the area of Alun-alun, so that it can be create a comfortable community. Street design conducted by observing road users and the types of activities that are in the area of Alun-alun.
	Jl. Zaenal Arifin	- hierarchy of the street is secondary collector - total of street reserve is 9m - the users are pedestrian, vehicle, motorcycle, and on street parking - there are complementary street ie traffic signs	
	Jl. Sersan Harun	- hierarchy of the street is secondary collector - total of street reserve is 9m - there are complementary street ie street signs	
	Jl. Kompral Usman	- hierarchy of the street is secondary collector - total of street reserve is 9m - there are complementary street ie street signs	
MOG			
	Jl. Bromo	- hierarchy of the street is primary local - total of street reserve is 17m - It is a city street	The width of the street does not meet the standard, only less than 0.5 meters from the standard so that vehicles can pass through Jl. Bromo exceed the existing standard. Opportunities widen the street at Jl. Bromo quite small, this is due to land in Jl. Bromo classified elite settlements.
	Jl. Basuki Rahmat	- hierarchy of the street is primary collector - Jl. Basuki Rahmat is connecting between the provincial capital (Surabaya City) with the capital district (kepanjen) and the city	

		centre of Malang City. - This road has a width of 5 meters. It is including median and curb. Street users on this corridor has an average speed of 40 km/hour, and the entrance to the street is not restricted.	The entrance to the primary collector road is not restricted to efficiently so this will cause resistance at the road.

Continued of Table 1

Sites	Links	Characteristics	Analysis
	Jl. Semeru	- Jl. Semeru connecting secondary region with other regions in the City of Malang. This road has a width of more than 7 meters road. Here include the median and the shoulder of the road in some way. Road users on this corridor has an average speed of 40 km/hour, and the entrance to the road is not restricted.	Based on the existing width of Jl. Semeru was appropriate (more than 7 meters) but the equipment road is less enough as the lack of road marker in accordance with the designation hierarchy.
	Jl. Kawi	- hierarchy of the street is primary local - This road has a width of 8 meters.	Jl. Kawi still in accordance with the appropriate standards of planning hierarchy
	Jl. Tangkuban Perahu	- hierarchy of the street is primary local - this road has a width of 3 meters.	For primary local hierarchy, Jl. Tangkuban Perahu not qualify for the primary local road for width of the road, but for the standard of the vehicle speed in Jl. Tangkuban Perahu fulfilled because there are vehicles driving at speeds less than 20 km/h.
TUGU			
	Jl. Brawijaya	- hierarchy of the street is primary local - this road has a width of 5 meters.	The width of the road is still under standard but the speed of the vehicle in accordance with the minimum speed limit.
	Jl. Tumapel	- hierarchy of the street is primary local - this road has a width of 6 meters.	
	Jl. Kahuripan (BCA)	- hierarchy of the street is secondary collector - this road has a width of 14 meters.	The width of the road is not in accordance with existing standards. Existing conditions both below and above the provisions of the width of the existing standards shows that the vehicle drove at speed standard.
	Jl. Kahuripan (KODIM)	- hierarchy of the street is secondary collector - this road has a width of 6 meters.	
	Jl. Majapahit	- hierarchy of the street is secondary collector - this road has a width of 14 meters.	
	Jl. Pajajaran	- hierarchy of the street is secondary collector - this road has a width of 5 meters.	
	Jl. Sultan Agung	- hierarchy of the street is secondary collector - this road has a width of 4 meters.	

Continued of Table 1

Sites	Links	Characteristics	Analysis
	Jl. Kartanegara	- hierarchy of the street is primary collector - this road has a width of 17 meters.	The width of the road and speed of the vehicle have met the standard. The problems are many activities in this area, and it raises congestion.

The majority of LOS in existing conditions for some links increased to get better when tested using BRO design. The LOS of the each links in 3 sites can be seen in the Table 2.

Table 2 LOS of Tugu sites

Links	Capacity (C)	Volume (V)	V/C	LOS
Jl. Kartanegara	5365,219	15696,4	2,93	B
Jl. Pajajaran	1404,435	595	0,42	C
Jl. Majapahit	2507,92	1065	0,42	C
Jl. Kahuripan	2181,89	1128	0,52	C

Design of BRO

BRO is designed specifically for the vehicle with low speed. Pedestrians have the same privileges to the vehicles. Several characteristics of BRO design are: (1) Elimination or removal of separation between motorcycle/vehicles, pedestrians and other street users; (2) Elimination of the traditional distinction between footpath and street, thus providing more space for pedestrians and other street activities (street restaurant, music, etc); (3) The device street such as curbs, lines, signs, signal is removed. It is replaced with integrated utilization, which is oriented to the public space so, walking, biking and driving the car into a controlled activity and instead holding a 'BRO' point of entry and exit to the city centre. BRO design is CONTRADICTING to the principle of segregation, the idea of separating functions and different users in the city. We put some design elements such as street furniture, artwork and other plants or flowers around the space. It encourages the speed of vehicles being SLOW.

Table 3 Design concept of BRO in the Tugu sites

Links	Concept
Jl. Tugu	
	Travel way
	▪ Limiting the width of travel way only for 4 meters. ▪ The use of paving materials as its pavement. There is no asphalt. ▪ There is a difference in color between pedestrian and travel way. ▪ There is no difference in 'high levels' between pedestrian and travel way.
	Pedestrian
	▪ There is no difference in 'high levels' between pedestrian and travel way. ▪ Widening the pedestrian way, the widest possible use of the remaining existing travel way narrowed. ▪ There is a difference in color between pedestrian and travel way.
	Ornament
	▪ There is added planter on the right side of the street. ▪ On-street parking is eliminated. Car/vehicle can stop within a specified period..
Jl. Kartanegara	
	Travel way
	▪ Limiting the width of travel way only for 4-5 meters. ▪ The use of paving materials as its pavement. There is no asphalt. ▪ There is a difference in color between pedestrian and travel way. ▪ There is no difference in 'high levels' between pedestrian and travel way.
	Pedestrian
	▪ There is no difference in 'high levels' between pedestrian and travel way. ▪ Widening the pedestrian way, the widest possible use of the remaining existing travel way narrowed. ▪ There is a difference in color between pedestrian and travel way.

Continued of Table 3

Links	Concept
Jl. Kartanegara	
	Ornament
	▪ Limiting the width of travel way only for 4 meters. ▪ Changes in the function of the green lane / boulevard into public space oriented to the park, so it does not eliminate the essence of a green lane. ▪ There is added 'public seating' in the area of public space. ▪ There is added pots of flowers on pedestrian. ▪ There is added street lights on both sides of public space.

Here is the design of the cross-section and longitudinal section of the concept of BRO in Tugu sites (Fig. 3 and Fig. 4). This reasearch try to propose two design for Tugu sites. First design can be seen in Fig. 3 and Fig. 5. Secondly design can be seen in Fig. 6.

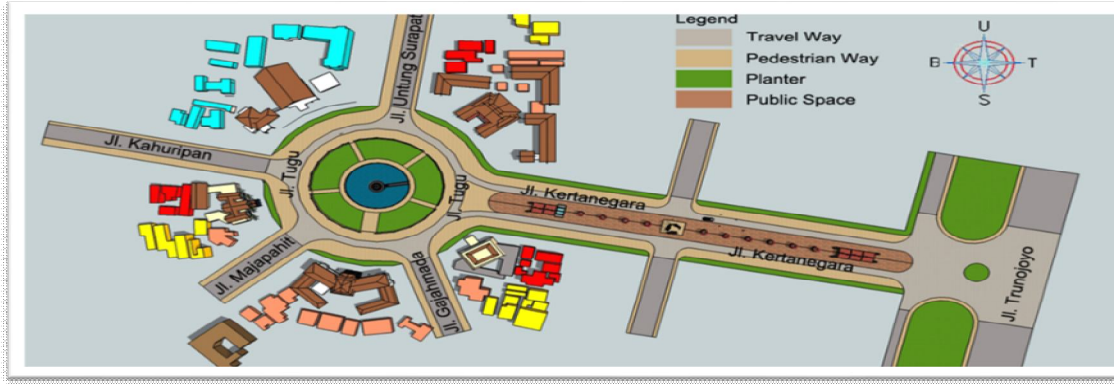

Fig. 3 The design concept of BRO in the Tugu sites

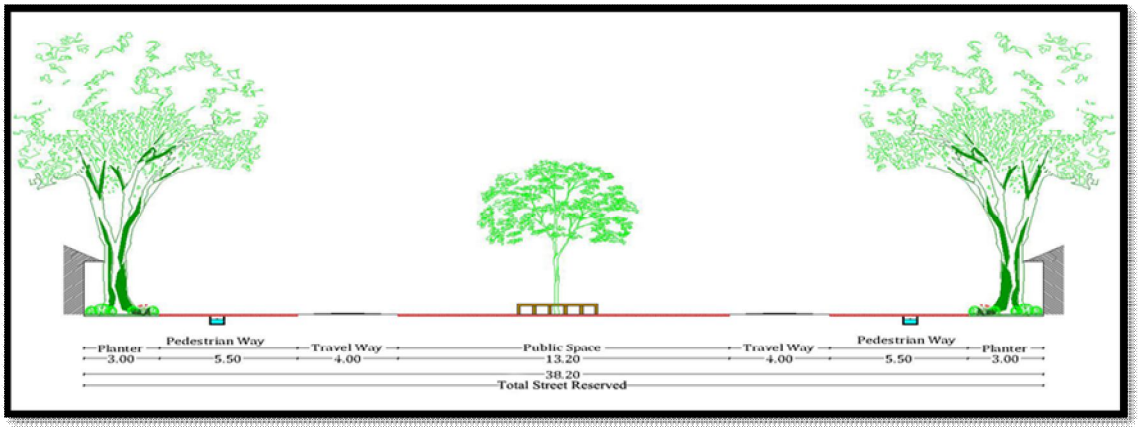

Fig. 4 Cross-section of BRO design in Jl. Tugu

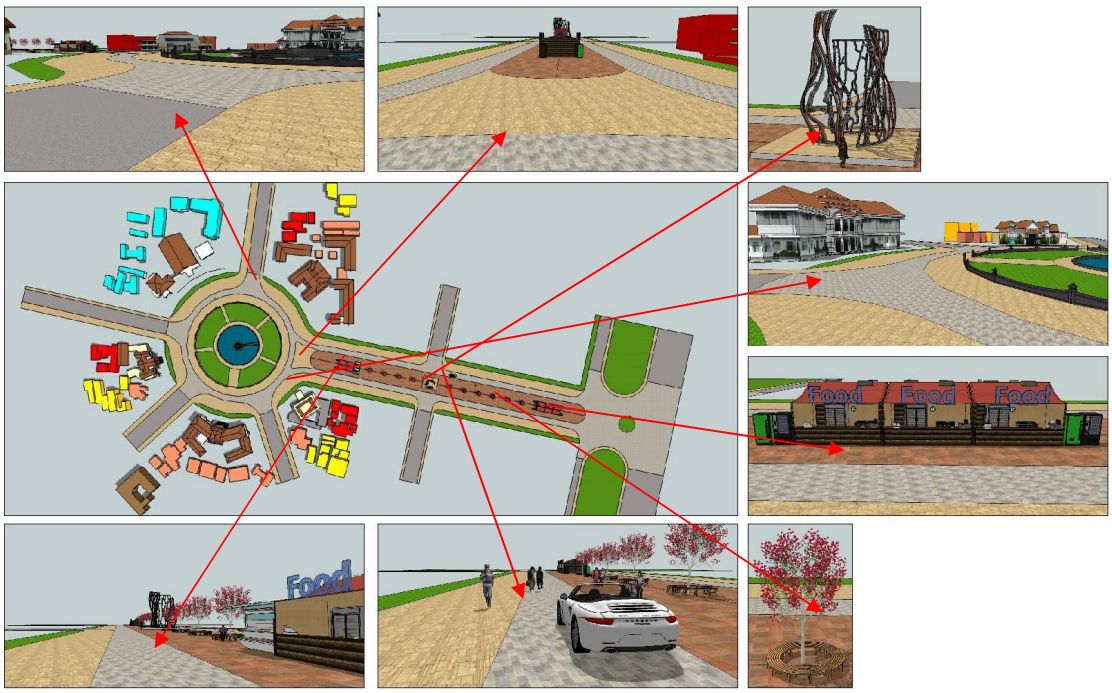

Fig. 5 BRO design of the Tugu sites in 3D

Fig. 6 BRO design of Jl. Kartanegara in 3D

The street design of some links is connecting with three sites also improved. New design of Jl. SW. Pranoto can be seen in Fig. 7. There is no difference in 'high levels' between pedestrian and travel way. Public transport and motorcycles have their own lanes. Their line is different with private car lanes. This is intended to avoid congestion.

Fig. 7 Photo design and 3D of Jl. SW. Pranoto

CONCLUSIONS

The design of BRO can be apply in the city centre of Malang to reduce vehicles speed and it makes comfortable for pedestrians, calm and clean, easy to move by public transport, kind to children and elderly people, easy to cooperate with citizens and visitors. This design is safe. This is due to both motorists and pedestrians are encouraged to be more careful with the surrounding environment and to each other. Example: the driver will instinctively slow down and make eye contact with pedestrians in the vicinity.

The authors hope that this study will give a new idea that can be used by other researchers and city government to creating a new design of street for the sustainability and liveability of the city centre in the future.

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REFERENCES

1. Hamilton, B. 2010. Shared Space and Street Design. *City Planning Institute on Japan*, June 25.
2. Communities and Local Government. 2007. *Manual for Streets*. Thomas Telford Ltd, London.
3. Commission for Architecture and the Built Environment (CABE) and ODPM. 2002. *Paving the Way: How we Achieve Clean, Safe and Attractive Streets*. Thomas Telford Ltd, London.
4. Disability Discrimination Act. 2005. London: TSO.
5. Department for Transport. 2002. *Inclusive Mobility A Guide to Best Practice on Access to Pedestrian and Transport Infrastructure*. London.
6. CABE. 2006. *The Principles of Inclusive Design*. London.
7. DETR. 1999. *Guidance on the Use of Tactile Paving Surfaces*. London.
8. Department for Transport. 1995. The Assessment of Pedestrian Crossings, *Local Transport Note* 1/95. London: TSO.
9. Department for Transport. 1995. The Assessment of Pedestrian Crossings, *Local Transport Note* 2/95. London: TSO.
10. County Surveyors' Society/Department for Transport. 2006. *Puffin Good Practice Guide*, available to download from www.cscnet.org.uk.
11. S.W., Budi, Surjono, S., Harnen. 2012. The Influence of Trip Attraction on the Road's LOS at Traditional Market Land Use. *JAEBS*. 2: 92-96.
12. Agustin, I.W., Kubota, H. 2012. An Appropriate Strategy to Anticipate Fringe-Settlements Development in the Rural-Urban Fringe Area, *J. Basic Appl. Sci. Res*. 2 (10), 10612-10619.
13. Agustin, I.W., Kubota, H. 2012. Changing Physic, Changing Pattern, and Conflict of Rural-Urban Fringe Using a Combination Model, *J. Basic Appl. Sci. Res*. 2 (12), 12722-12730.
14. Kubota, H., Uemura, T., Kojo, M., and Sakamoto, K. 2006. Transportation Demand Omotenashi (TDO): an Idea and an Analysis, 考察 管理からおもてなしへ土木学会 土木計画学研究・論文集 23:711-716.