Chapter 6

Strengths and limitations of the transport category in the green star South Africa rating system

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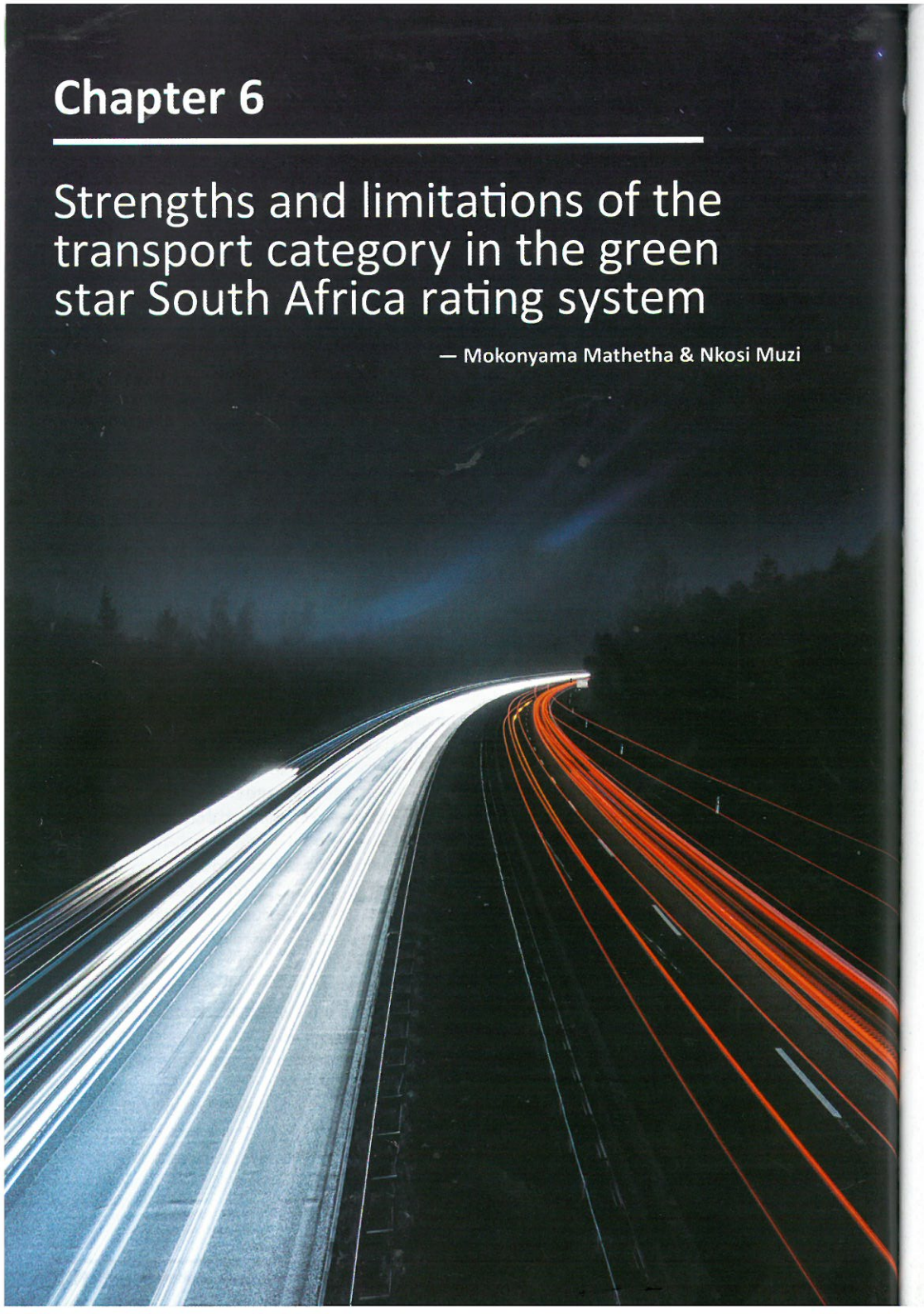

Abstract

The chapter evaluates the strengths and limitations of the Green Star South Africa's rating scheme in respect of its transport environment category. The evaluation is necessary, among other things, to guide decision makers on the interpretation of the tool's outcomes for general transport planning. Using office buildings that have already been rated in Gauteng Province as case studies, and comparison of the tool with similar other tools in the world, it was found that while the tool evaluates the right dimensions, it remains fundamentally flawed by disregarding the network-based nature of transport services and operations, as well as the travel behaviour of building users. Prospects for improving the calculator are discussed. The role of transport planning authorities to support Green Building Council South Africa and developers in this regard is seen as critical.

Introduction

The Green Star South Africa rating scheme is one of the many such schemes in use globally, including the Green Mark Scheme (GMS) in Singapore, Leadership in Energy and Environmental Design (LEED) in the United States, Building Research Establishment Environmental Assessment Method (BREEAM) and Comprehensive Assessment System for Built Environment Efficiency (CASBEE) in Japan, and Green Building Council of Australia Green Star (GBCAGS) in Australia. Haddad (2017) identifies 17 such schemes in the world. However, BREEAM, LEED and Green Star Australia have found the widest application (Roderick et al., 2009). Collectively, these schemes have the primary objective of measuring and reporting on the performance of buildings in terms of the ability to minimise their lifecycle energy consumption, greenhouse gas emissions and water consumption. For example, a green building has, potentially, half the energy requirements of a conventional building (DEA, 2009).

A broader definition of a green building requires a triple bottom-line approach, namely environmental, social and economic considerations (Illankoon, et al., 2017; Zuo and Zhao, 2014). This ties with the concept of sustainable transport, which is characterised by a transport system that promotes (i) liveable streets and neighbourhoods, (ii) environmental protection, (iii) equity and inclusion, (iv) health and safety, and (v) support of an efficient and vibrant economy (Castillo and Pitfield, 2010). Nonetheless, social and economic considerations are rarely included in the ratings (Zuo and Zhao, 2014; Doan, et al., 2017), notably in LEED and Green Star Australia (Xia et al. 2013). There are also instances where the use of one scheme results in a high rating, yet the same building scoring much lower or failing a certification using another scheme (Roderick et al., 2009). Incongruities between ratings and end-user satisfactions have also been reported (Altomonte et al. 2017). In the light of these concerns, the chapter assesses the strengths and limitations of the transport category of Green Star South Africa rating system in terms of significance, comprehensiveness, relevance, accuracy and viability. This is important to help communicate what green star rating truly represent in the transport planning and management context. The assessment also reviews prospects of functionally improving the tool.

Background

Within their computational frameworks, green building rating schemes incorporate building functional categories that include energy, transport, water, materials, waste, land use and ecology, health and wellbeing of users, pollution and innovation. Each category contains credits that can be earned through fulfilling specified criteria. Credits are usually a function of the extent to which measures are implemented to reduce energy consumption and greenhouse gas emissions.

The Green Star South Africa rating scheme, founded on the Australian Green Star, was introduced in 2008 by the Green Building Council South Africa (GBCSA), much later than BREEAM in 1990 and LEED in 1998. To aid its implementation, the Green Star SA software platform Office Version 1 was released, followed by Version 1.1 in 2014. In June 2017, GBCSA released a scoping paper for the Green Star SA-New Build Tool-Version 2. The New Build Tool platform is scheduled for launch in August 2018. In this new platform, four different rating tools (office, retail, residential and public/education) will be combined into a single tool, in line with international trends (GBCSA, 2017b). However, the scoping paper makes no mention of modifications to the transport category of the rating system.

Whereas in 2017 over 200 buildings in South Africa had received certification, over 661 600 buildings around the world had been certified through BREEAM alone. Certification of green buildings in South Africa appears to be subdued by certification costs and the absence of government incentives (McGraw Hill Construction, 2013). Nonetheless, most of

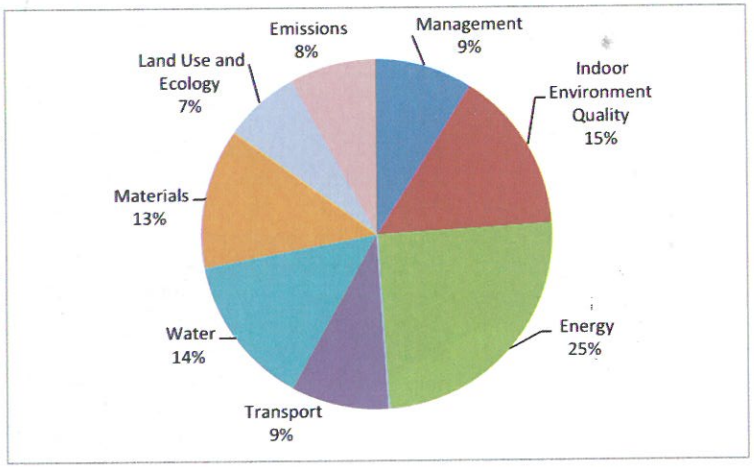

Figure 1: Sectoral weights in the Green Star South Africa tool

Table 1: Overall scores and ratings in the Green Star South Africa tool

Overall Score	Rating	Ratings outcome
10 - 19	One Star	Not eligible for formal certification
20 - 29	Two Star	Not eligible for formal certification
30 - 44	Three Star	Not eligible for formal certification
45 - 59	Four Star	Eligible for Four Star Certified Rating that recognises/rewards 'Best Practice'
60 - 74	Five Star	Eligible for Five Star Certified Rating that recognises/rewards 'South African Excellence'
75+	Six Star	Eligible for Six Star Certified Rating that recognises/rewards 'World Leadership'

South Africa's certified buildings are in Gauteng (56%), followed by the Western Cape (31%) and KwaZulu-Natal (9%). More than half of the certifications in Gauteng were for offices.

Considerations for green transport alternatives for use of buildings is a progressive new phenomenon in South Africa. Traditionally, the interface between buildings (land uses) and transport has mainly been limited to the use of various design guidelines, for example COTO (2012), to estimate minimum parking requirements and operational capacity of supporting transport infrastructure. For example, offices are expected to generate 8.5 vehicle trips per day (combined for both entry and exit) for every 100m2 of Gross Leasable Area from which the required transport infrastructure is estimated. Nonetheless, such approaches are criticised for lack of micro-economic considerations (Shoup, 1999) and failure to advance the development of sustainable transport systems (Mingardo et al., 2015).

Overview of green star south africa's transport category

The Green Star South Africa rating system has rating tools for purposes that include existing building performance, interiors, office, public and education, multi-unit residential, retail and sustainable precincts. Given that offices constitute most of the rating in Gauteng Province, the Office v1.1 tool was selected for further interrogation. Office v1.1 was released in 2014 and received only minor changes from the original 2008 version. The change log shows that the transport category has had no changes since 2008 (GBCSA, 2014).

Figure 1 shows the relative categorical weights used in Officev1.1 tool. Eight categories are used namely: management, indoor environmental quality, energy, transport, water, materials, land-use and ecology, emissions, and innovation. Transport has a relative weight of 9%. The scoring and overall rating system is summarised in Table 1. Buildings with overall scores (credits) below 45 are not eligible for formal certification. A Four Star rating is considered "Best Practice", followed by Five Star rating ("South African Excellence") and Six Star rating ("World Leadership").

Transport has a maximum of 14 points derived from five credits, namely provision of car parking, fuel efficient transport, cyclist facilities, commuting mass transport, and extent of trip reduction through mixed use. The credits, together with their intended objectives and credit aim are summarised in Table 2. Provision of car parking (14%, which is the available points for this specific credit divided by the total points available for the transport category) rewards initiatives to minimise the need for parking. Fuel efficient transport (14%) rewards initiatives to encourage the use of more fuel efficient vehicles. Cyclist facilities (21%) is rated higher than the previous two, and rewards initiatives to facilitate the use of bicycles for the building. The commuting mass transport (36%) rewards the use of mass transport services to access the building. The points are awarded on the basis of the type of mass transport services available within 1km of the site, the number of routes serving the site, and public transport service headways during weekday peak periods. Finally, local connectivity (14%) rewards the location of building in mixed use areas.

Office v1-1 manual specifies criteria for the awarding of points for the different credits as follows:

Provision of car parking: Up to two points are awarded as follows: One point is awarded where the number of car parking spaces is: At least 25% lower than the maximum local planning allowances applicable to the project; or Not exceeding the minimum Department of Transport (DoT) guidelines by more than 10% or not exceeding the local planning minimum allowances by more than 10%, whichever is lower. Two points are awarded where the number of car parking spaces is: At least 50% lower than the maximum local

Credit Code	Credit name	Aim of credit	Points available	Percentage in transport category
Tra-1	Provision of car parking	Encourage and recognise developments that facilitate the use of alternative modes of transport for commuting to work	2	14
Tra-2	Fuel-efficient transport	Encourage and recognise developments that facilitate the use of more fuel efficient vehicles for commuting to work	2	14
Tra-3	Cyclist facilities	Encourage and recognise developments that facilitate the use of bicycles by occupants and customers	3	21
Tra-4	Commuting mass transport	Encourage and recognise developments that facilitate the use of mass transport for commuting to work	5	36
Tra-5	Local connectivity	Encourage and recognise developments that are built in mixed-use areas in order to reduce the number of trips and trip lengths	2	14
		and trip lengths		
Total points			14	100

Table 2: Credits for the transport category

planning allowances applicable to the project; or not exceeding the minimum DoT guidelines or not exceeding the local planning minimum allowances, whichever is lower.

Fuel efficient transport: Two points are awarded where: A minimum of 5% of all parking spaces are dedicated solely for use by car-pool vehicles, car share vehicles, hybrid or other alternative fuel vehicles. All qualifying spaces must be located in preferred parking locations and be designed and labelled for the intended vehicle types; and a minimum of 5% or 5 parking spaces (whichever is the greater) are designed and labelled for mopeds, scooters and/or motorbikes, and all of these must be located in preferred parking locations.

Cyclist facilities: Up to three points are awarded as follows: One point is awarded where the following are provided: secure bicycle storage for 3% of building staff, accessible showers, changing facilities adjacent to showers, and one secure locker per bicycle space in the changing facilities. Two points are awarded where the following are provided: secure bicycle storage for 6% of building staff, accessible showers, changing facilities adjacent to showers; and one secure locker per bicycle space in the changing facilities. An additional point is awarded where: the requirements for either one or two points have been met; and visitor bicycle parking is provided and meets the following criteria: one space per 750m^2 usable area or part thereof; and provided in an accessible location, signposted and close to, or adjacent to, a major public entrance to the building.

Commuting mass transport: Up to five points are awarded for the quality of mass transport options available to building occupants. The points are determined using the Green Star South Africa Commuting Mass Transport Calculator based on the number of public transport services provided in each of these categories: (i) The type of mass transport services available within 1km of the site, (ii) The number of routes served; and (iii) the average interval between services during weekday peak hours. Trains get relatively more points than road based services, and contracted road based services get more points than non-contracted services.

Local connectivity: One point is awarded where: any four of the following are located within 400m of a public entrance to the building: Bank/ATM, convenience grocery/supermarket, day care, cleaners/laundry, medical/dental offices, pharmacy, post office, restaurant/canteen/cafeteria, fitness centre/gym, library, school. An additional one point is awarded where: there is a minimum average gross density of 35 du/ha (dwellings units per hectare) for the entire area within 400m of the office development.

It is clear from the above allocation of points that the allocation system is supply driven. This is because it is largely assumed that by implementing such interventions as reduced parking spaces, and locating the building near public transport routes, that the users of the building will respond accordingly.

In terms of publicity and end-user interactions, GBCSA initiated stakeholder engagements about the major version change to a Green Star South Africa New Build Tool (GBCSA, 2017a; GBCSA, 2017b). The associated report was published in April 2017. Furthermore, GBCSA conducted online surveys, telephonic interviews, focus groups, external scoping workshops and also requested consultants to do a credit-by-credit review of the rating system.

In terms of the review, majority of consultants felt that only minor or no changes to the commuting mass transport credit needed to be made. They also felt that a benchmark update is not needed and that this credit should not be removed. They also felt that there is a low level of cost associated with this credit. One company remarked that the

credit does not inspire change, while another commented that submission documentation is complicated.

Table 3 provides a summary assessment of how transport is treated in other rating schemes (BREEAM, LEED, and Australia's Green Star). While not completely comparable, key differences between South Africa's Commuting Mass Transport calculator and other tools are in terms of: transport's relative weight in the system, size of the credit points, linkages with transport authority transport planning tools, and the definition of public transport access.

Situational analysis of buildings already rated in gauteng province

Figure 2 shows the location of buildings that have already been green certified in Gauteng Province. The buildings tend to be clustered and located near arterial roads. Out of all the rated buildings, five were selected, ranging from Four to Six Star rating, for further situational analysis. For these five buildings, Table 3 provides some of the transport-related indicators derived from the 2014 Gauteng household travel survey (GDRT, 2014), that are associated with areas (transport zones in the Gauteng Province's Strategic Transport Model) in which the buildings are located.

All the relevant areas selected (transport zones) have sizable numbers of incoming and outgoing person trips in the morning peak period (06h00 to 09:00). With regard to mode split i.e. train, bus, minibus taxi (taxi), non-motorised transport (NMT), private car, and other; the predominant mode of transport for trips to/from areas in which these building are located is private cars. Besides minibus taxis, public transport makes a very small proportion of trips in these areas, even for a building with a Six Star rating ("World Leadership"). In fact, a further analysis of proximity of all the rated buildings in Gauteng Province, to public transport services, shows that 37%, 89%, and 100% of these buildings are within 1km of rail lines, bus routes, and minibus taxi routes, respectively.

Nedbank Lake View building, with a Four Star rating, is located within an area with a relatively large proportion of non-motorised trips. Despite this, the building only scored less than 50% of the points in the transport category for this development. The observed disconnect between transport and the building performances is because mode split is influenced by many other built environment attributes such as density, urban form, and accessibility in relation to traveller attributes (Holtzclaw, 1994; Ewing & Cervero, 2001; Murray, et al., 1998; Dargay & Hanly, 2003), which is not explicitly taken into account in the tool's evaluation framework. Similarly, increased parking cost is most effective for reducing parking demand (Christiansen, et al., 2017), and the availability of free parking results in travel behaviour that is inelastic to such things as mode choice incentives (Hamre and Buehler, 2014). Restricting parking on the other hand could have unintended consequences of overspill to the surrounding areas (Melia & Clark, 2017). With regard to cycling, the absence of good cycling infrastructure in the functional area of the property greatly reduces attractiveness of cycling trips (Hunt & Abraham, 2007; Larsen & El-Geneidy, 2011). Many of these micro-economic considerations, however, are not taken explicitly into account within the tool's evaluation framework.

For the selected buildings, average trip lengths, most of them by private car, range from 30 to 42 minutes. A Six Star rated building is located in an area with an average trip length of 38 minutes. Public transport access times for trips originating or destined in these areas are particularly long for train users and much shorter for minibus taxi users. Under these circumstances, locating a building near public transport routes, without considering

Tool	Notable features
BREEAM (BRE, 2016; TfL, n.d.; TfL, 2015)	• Transport has a weight of 6.77% of available credits • There are 13 credits available in the transport category and up to 5 credits are available for public transport accessibility • Unlike Green Star SA, frequency of service is defined as the average number of services stopping per hour at each node during the operating hours of the building per day and not during peak periods. • For buildings in the Greater London area, BREEAM allows for the use of Transport for London's WebCAT (Web-based connectivity assessment toolkit) to find an area's Public Transport Accessibility Level (PTAL) which can be used as evidence for Accessibility Index points.
LEED (USGBC, n.d.; USGBC, 2014)	• Public transport access is classified under the location and transportation category. • Access to Quality Public Transport has up to five credits. • If any bus, streetcar or informal public transport stop is within ¼ mile (400m) walking distance of the building or any bus rapid transit stop, rail station or ferry terminal is within a ½ mile (800m) walking distance, then the public transport services at those stations and stops must meet some minimum requirements for both weekday and weekend trips. • Projects served by one or more public transport routes such that no one route provides more than 60% of the prescribed levels may earn one additional points, up to the maximum number of points.
Green Star (Australia) (GBCA, 2015)	• Green Star has developed a unique Public Transport Accessibility Index (PTAI) to determine a project's accessibility. Instead of using the BREEAM's PTAL methodology it uses overall accessibility modelling. • Green Star measures accessibility as the number of project occupants that can access the nominated destination through the use of public transport within a 45 minute travel time threshold. This 45 minute threshold is a door-to-door travel time that includes walk time to and from the public transport stop at both ends of the trip, in-vehicle time, wait/transfer time and "dead" time (the difference between the desired arrival time and the actual arrival time (GBCA, 2015). • Up to three points are available for the 'Access by Public Transport' credit. The points are awarded in accordance to the proportion of city residents that can access the nominated area in 45 minutes using public transport compared to the total population of the city's total population.

Table 3: Summary assessment of the notable features of how transport is treated in other schemes

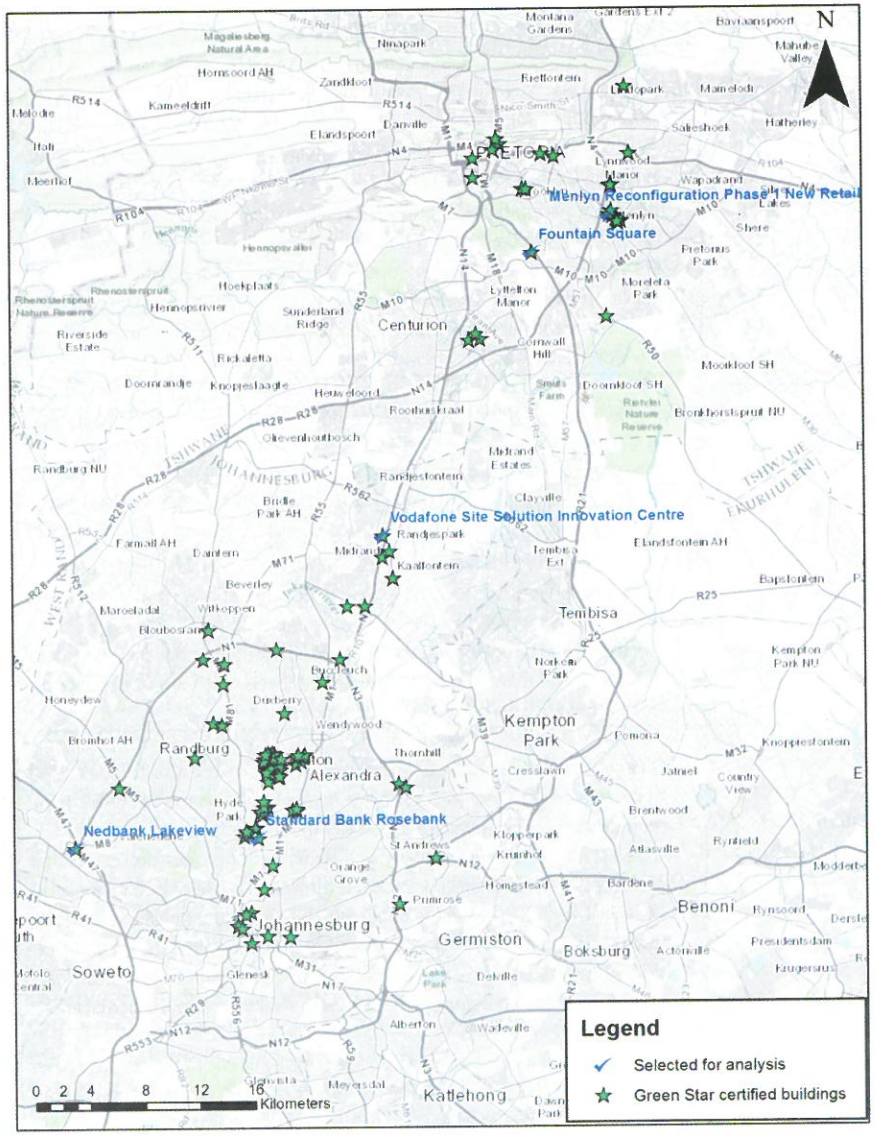

Figure 2: Location of green certified buildings in Gauteng Province

Name of certified building		Vodafone Site solution Innovation Centre	Nedbank Lakeview	Standard bank Rosebank	Menlyn Reconfiguration Phase1	Fountain square
Green star type		Office	Office	Office	Retail Centre	Existing Building performance
Green Star South Africa Rating		6	4	5	4	4
Reported transport category points achieved (As % transport category points)		<50%	<50%	50%-60%	90%-100%	90%-100%
Modal split (%)	Train	1	3	1	0.20	0.10
	Bus	3	8	2	2	2.7
	Taxi	13	19	5	2.50	3.4
	NMT	6	35	10	6	12
	Private	74	35	82	87	81
	Other	3	0	0	2	1
Average trip length for all trip purpose (min)		38	44	30	38	42
Total person trips (06h00 - 09h00)	Origin	29 077	69 611	24 543	15 993	51 955
	Destination	38 013	96 563	77 826	40 893	47 544
Mean household Access times to public transport services (min)	Train	38	20	20	27	32
	Bus	15	11	10	8	8
	Taxi	8	8	9	10	10

Table 3: Transport related data for selected green certified buildings in Gauteng

the quality of the service, which users would ordinarily do, limits the efficacy of the tool's evaluation framework.

What is clear in this situational analysis is that, from a transport perspective, building performance ratings in the Green Star South Africa tool, have little to do with the functional relationship between the users of the building and the operations of transport within the functional area of the building. Buildings are essentially rated in isolation of surrounding transport conditions. It is unlikely therefore that a high rating using the current tool would be indicative of desirable transport conditions within the functional areas of the building.

Consolidated evaluation of green star south africa's transport category

The Green Star South Africa transport category has the stated objective of rewarding the reduction of automotive commuting by simultaneously discouraging it and encouraging use of alternative transport. While

this is acknowledged, Table 4 summarises some of the tool's observable strengths and limitations (including its co-benefits) for each credit based on the observations made on some of the buildings that have already been certified and transport literature.

Many of the tool's weaknesses in Table 4 relate to its disregard for transport performance in a network context as indicated in the previous section. In contrast, Australia's Green Star rating tool comes close to taking the network context into account in that it measures accessibility as the number of building users who can access the building/area by public transport within a 45 minute travel time threshold (which South African buildings are not likely to pass). Such levels of accessibility would be truly indicative building accessibility by public transport. Moreover, in a network context, individual travellers make decisions about where to travel, which mode of transport to use, what time to travel, which route to use, and which destination to travel to by evaluating all known options in the network. In the manner built (supply oriented and insensitive to travel behaviour in a transport network), the South African tool cannot therefore be used to make inferences about the sustainability of rated buildings from a transport perspective.

Future updates of the tool should consider incorporating network effects in order to improve its effectiveness, for example using network transport models to estimate the nature of travel demand in which buildings are located. The application of simplified modelling approaches, yet behaviourally rich, for the South African contexts suggested by Venter and Mokonyama (2009), should be explored. The retrospective use of actual travel behaviour as opposed to assumed travel behaviour from the supply of "green" transport infrastructure would also serve to truly evaluate the building performance from a transport perspective. Improved incorporation of traveller characteristics would also render the tool more useful, especially with regard to minimising unintended social exclusion.

Conclusions

The chapter reviewed the strengths and limitations of the Green Star South Africa rating scheme in respect of its transport environment category. The transport category has the stated objective of rewarding the reduction of automotive commuting within the built environment by concurrently discouraging it and encouraging use of alternative transport. The credits and associated points of the transport category were reviewed in detail, and comparisons with similar tools used elsewhere in the world were drawn. The chapter also provided a situational review of selected green certified buildings in Gauteng Province.

It is concluded from the review of the transport category of Green Star South Africa's rating scheme that the tool requires significant improvements in order to truly be reflective of sustainable transport ideals. This is because the tool is currently configured for isolated assessments of buildings as opposed to evaluating such buildings in the required transport network context. Results from the ratings are therefore more reflective of assumed probable behavioural outcomes from the supply of "green" transport infrastructure elements as opposed to the actual functioning of buildings to reduce transport-related energy use and emissions. Despite the onerous requirements in the form of support documents to implement the transport tool, as expressed by some industry representatives that submission documentation is complicated, the outcomes of the ratings produce limited returns for transport planning purposes.

The review of similar tools from other parts of the world shows that collaboration between developers and authorities may be essential to improve its efficacy, for example, using the authority's network transport models and associated datasets. The retrospective use of actual travel behaviour as opposed to assumed travel behaviour from the supply of "green" transport infrastructure would serve

Rating dimension	Strengths	Limitations
Provision of car parking	▪ Possibility of realising reduced number of vehicle trips per building. ▪ Physical reduction of expensive urban space devoted to the use private cars. ▪ Developers are able to increase the size of lettable area. ▪ Reduced overhead cost for tenants from reduced parking space costs.	▪ Implemented in isolation there may be diversion of trips to other areas of the network without parking restrictions. This in turn may result in increased vehicle kilometres in the network, and in turn increase greenhouse gas emissions. ▪ Possible increased number of illegal parking on-site if there are no alternative travel modes. ▪ Exclusion of user charges for parking spaces limits behavioural responses.
Fuel efficient transport	▪ Reduction of vehicle kilometres per trip to or from the building. ▪ Incentive for more building users to consider hybrid/alternative fuel vehicles. ▪ Incentive for building users who already practice ridesharing or have hybrid/alternative fuel vehicles.	▪ Increased use of mopeds, scooters and/or motorbikes which actually pollute relatively more than cars. ▪ Exclusion of an average vehicle owner at the expense of higher income individuals given the relatively high prices of alternative fuel vehicles.
Cyclist facilities	▪ Incentive for building users who already use bicycles. ▪ Incentive for more building users to consider using bicycles.	▪ Trip lengths in South Africa are typically long and not conducive for cycling. ▪ In the absence of an appropriate cycling network in the functional areas of the building, cyclists will have high risk exposure.
Commuting mass transport	▪ Incentivises developments in the vicinity of high capacity public transport services.	▪ Public transport services in the vicinity of the building, that are used to rate the building, may not be functionally linked to the building itself. ▪ Places burden on developers who have little control on the development

		control on the development and management of a public transport networks. ▪ While minibus taxis are prevalent, emphasis is placed on contracted services. ▪ Incentivises resource constrained peak travel on public transport and disregards the need to incentivise improved use of off-peak services. Low occupancy off-peak services pollute relatively more per vehicle kilometre.
Local connectivity	▪ Potential to reduce number of motorised trips per building user. ▪ Potential to increase the proportion of non-motorised trips.	▪ Assumes functional linkages between the building and surrounding land uses. Such functional linkages are likely to be limited if implementation is in isolation of a wider spatial development strategy and result increased network congestion in the vicinity of the building.

Table 4: Strengths and limitations of South Africa's transport environmental category

to truly evaluate the building performance from a transport perspective.

Recommendations

Fundamental updates of the Green Star South Africa rating scheme in respect of its transport environment category are warranted. However, this should be a collaborative initiative between the Green Building Council of South Africa and transport planning authorities in the country. In this regard, transport planning authorities should produce up to date transport network data and tools for use by developers in applying the rating tools. A basic green transport map of a city should in fact be the responsibility of transport planning authorities. Given voluntary nature of the rating schemes, such collaboration is likely to incentivise more developers to use the rating tools.

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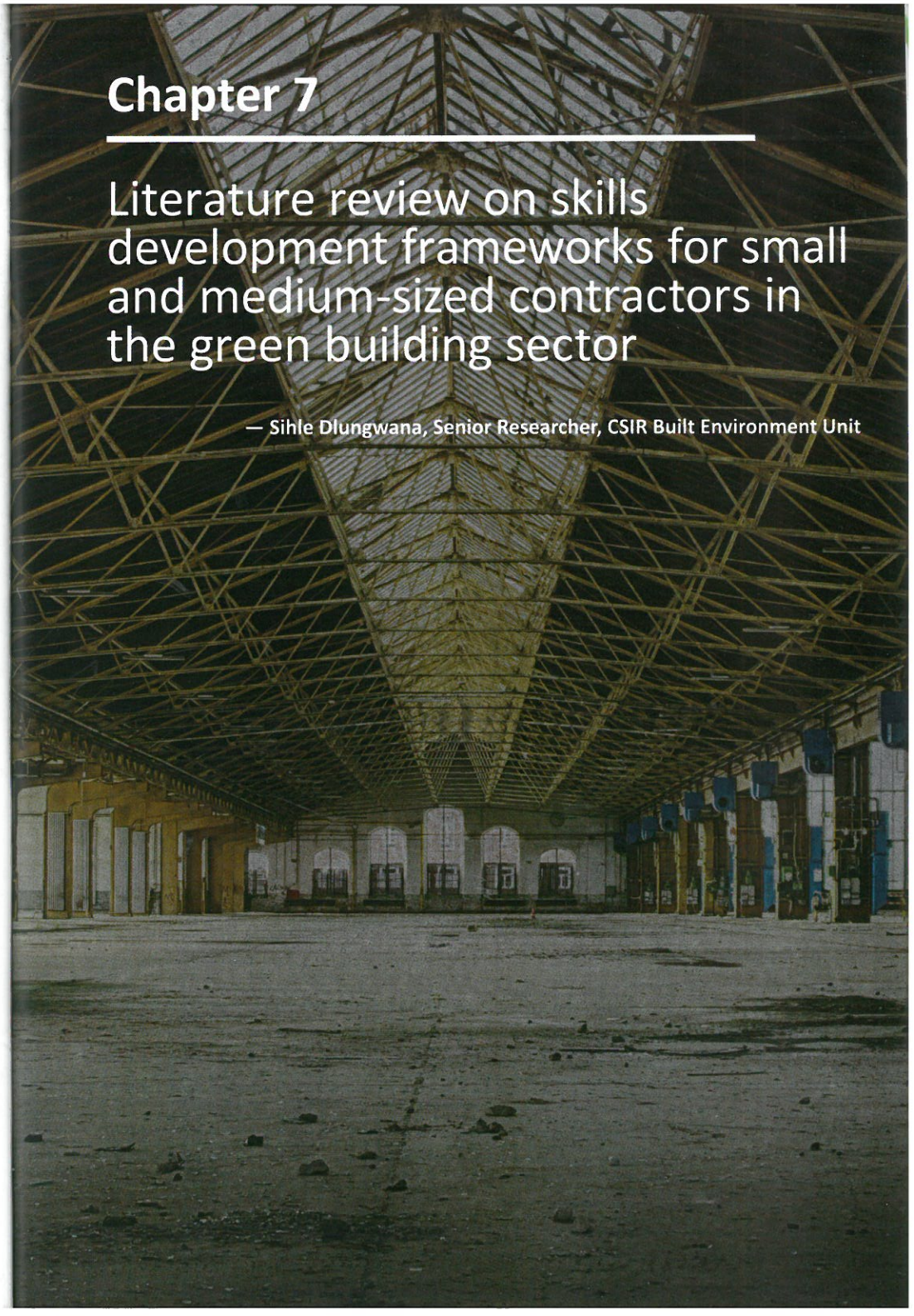

Chapter 7

Literature review on skills development frameworks for small and medium-sized contractors in the green building sector

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