IMPACT OF INTERCHANGES ON LAND USE CONVERSIONS AND LAND VALUE VARIATIONS IN THE SOUTHERN EXPRESSWAY, SRI LANKA

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Abstract

Road network is considered to be one of the most key infrastructures of any country. The improvements to the transportation system is always carried out under a socioeconomic context. Thus far, the developmental policies and strategies have largely concentrated on physical capital, but of late the focus has veered towards human capital issues as well. It is important to strike a balance between the two because physical and human capital generally go hand in hand. Expressway concept in Sri Lanka was initiated by opening of Kottawa to Galle in 2011. Southern Expressway is a new experience to transport system in Sri Lanka as well as to the real estate market. As the result of the construction of expressway, the land market in surrounding areas has fluctuated according to different ways. The arterial road network with nodes and linkages are interconnected with expressway through the interchanges. As a result, lager bare lands and agricultural properties are getting blocked out for residential uses as the demand for residential properties in the surrounding areas have surged. In Sri Lanka, not many research have taken into consideration the issues of the selected interchanges in the Southern Expressway. Therefore, a clear research gap exists in relation to this area and this research focuses on filling the gap. Hence, this research primarily focuses the impact on land use conversions and land value variations in the Kurundugahahethekma interchange.

Key words: Land Use Changes, Land Value Variation, Expressway, Interchange Land Use Conversion

Introduction

The 'transport system' is a key component of infrastructure and plays a pivotal role in the development of the economy. This has been accentuated by the global situation where the economic opportunities depends not only on the mobility of people and freight but also on information and communication technologies. This can be clearly seen when taking in to account, comparisons of the quantity and quality of transport infrastructure and the level of economic development in certain countries. Hence, sophisticated transport systems and highly connected networks generally entail high levels of economic development. According to the context of Sri Lanka,five categories of road network can be seen in the country. These are Express ways (E), National roads [A (AA,AB,AC) and B], Provincial roads (C and D), Local authority roads (E) and Other roads (RDA, 2014).

Highways are considered to be topmost on the hierarchy of the road categorization. Highways are constructed for the process of inter connecting major cities in a country. If by some chance 'a highway' connects only two main cities, then it will not be considered an efficient or effective

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highway network. Therefore, the 'efficiency of a highway' depends on the way it is connected to nearby cities that it runs through using interchange points. In Sri Lanka, national highways are "A grade" roads and the highway is at the top of the hierarchy. This is a whole new experience to the country.

Road networks provide the ease of access. 'Accessibility' is one of the main deciding factors when it comes to making decisions on the use of land in any given area. Accessibility to and from major roads as well as easy access to nearby cities provides many advantages in the utilization of land. The level of accessibility to a land depends on the way in which the respective land is going to be utilized for. For example, if the said land is going to be used for residential purposes, then easy access to their job locations, is a pivotal factor, hence it must facilitate easy access to schools, hospitals, shops, recreational facilities, religious places and etc.. But if the said land is going to be used for commercial purposes, then the requirement changes to catchment area, service facilities, complimentary shop locations, agglomeration factors, easy accessibility to materials, labour and market. Therefore, the condition or the status of the road network is vital because it should be able to provide motorable access to the above land uses.
One of the most significant advantages of highways is that they increase the number of existing or potential residential areas within commuting distance of jobs, shopping, recreation, and other activities. This increase in user accessibility – the reduction in travel time and operating costs associated with moving from point A to point B – is the most important direct benefit that accrues to highway users (Gamble, et al, 1973).

In Sri Lanka the expressway connecting Colombo to the country's southern province has no doubt become one of Sri Lanka's most successful stories in terms of the country's expressway network. Southern expressway is the first expressway in the country and it consists of eleven interchanges from Kottawa to Godagama. They are Kottawa (Makumbura), Kahathuduwa, Gelanigama, Dodangoda, Welipanna, Kurundugahahethekma, Baddegama, Pinnaduwa, Deegoda, Kokmaduwa and Godagama. This is the longest express way out of the expressway network and as a mega project Southern expressway has been declared as a milestone in Sri Lanka's development history. Previously most interchanges were small junctions but after the construction of the expressway those places have become famous towns and have transit- based development.

Benefits of Southern Expressway are mainly the reduced travel time between Colombo and Matara, reduced traffic congestion on the Colombo-Matara Road, reduced delay costs and fuel costs, which thereby contributes to the national economy and the development of fisheries and agriculture industries in the region. In addition to that, property developers have taken advantage of the various new expressways in the pipeline by planning ahead and investing in areas which are in close proximity to these expressways and exit points, which no doubt will see an increase in the price point in the coming years. Due to these benefits expressways create high land values around the interchanges and further land use patterns are converted. Accessibility through the expressway is a new experience to Sri Lanka's property market. After the development and improvements of the Southern expressway, there are many changes in land uses and land values in the vicinity of the interchanges and surrounding areas. The reason assumed for that is, to be that of the construction of the Southern expressway. Therefore, as a valuer or appraiser, there is a significance to identify the changes of the situation and how it affects on property market. Hence main objective of the study is to assess impact of interchanges on land use conversions and land value variations in the Southern Expressway. To achieve main objective two specific objectives were developed such as To identify impact of interchanges on the land use conversions in the Southern Expressway and identify impact of interchanges on the land value variations in the Southern Expressway.

Data and Methods

The study is based on the primary and secondary data sources. Primary data was collected by observation, interviewing and questionnaires while the secondary data was collected through documents and images (Government publication, earlier research, satellite images, personal records etc.) The data will be collected through structured questionnaire and semi-structured interviews with the people of the adjacent areas, professionals and responsible government authorities

the Hedonic pricing model to identify the impact of interchanges on land value variations. Researcher has followed the following conceptual framework to identify the impact of interchanges on land use conversions and land value variations in the Southern Expressway.

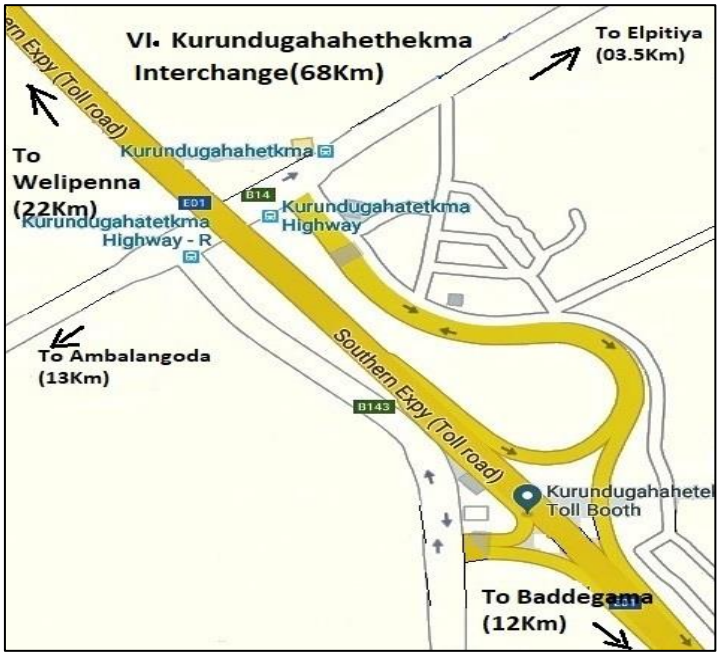
Conceptual Framework of the Study.

lands as samples. Selected 50 observations from Kurundugahahethekm aand 50 observations from Baddegama to collect variables for the conceptual framework.

Study Area

Kurundugahahethekma is a small town in the Galle District of the Southern Province of Sri Lanka. It is located approximately 39 Kilometers away from the Galle city. Part of Kurundugahahethekma town is situated within the administrative limits of ElpitiyaPradeshiyaSabha and Elpitiya Divisional Secretariat Division. The other part is situated within the administrative limits of KarandeniyaPradeshiyaSabha and Karandeniya Divisional Secretariat Division. From Kottawa, Kurundugahahethekma is the sixth exit/entry point of the Southern expressway.

Figure 1: Layout Plan of Kurundugahahethekma Interchange



Source: www:rda:gov:lk/supported/expressways/stdp:htlm

The close proximity to Kurundugahahethekma town is Kurundugahahethekma interchange. Elpitiya and Ambalangoda towns are located 03.5 Km away and 13.5 Km distances respectively. This interchange directly connects with Elpitiya – Ambalangoda and Elpitiya – Galle main road. The data collection catchment of the interchange was considered that 02 Km radius from interchange point (02 Km Buffer Zone) as a constant factor irrespective of interchanges. A 02 Km buffer zone was created using a GIS map analysis and the map is shown in Map No. 3 as below; It was observed that the 02 Km distance of the radius consists of 03 GramaNiladhari (GN) divisions. Table 1 shows the distribution of the residential and agricultural properties within the 03 GN divisions within the buffer zone.

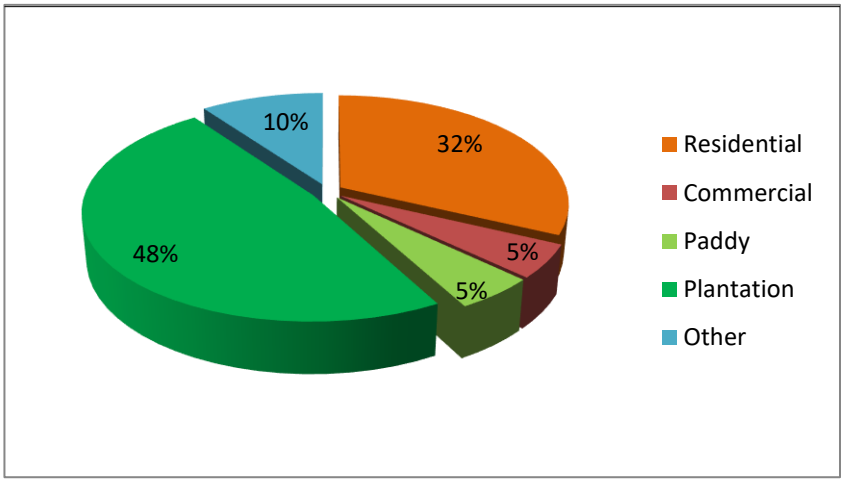
Table 1: Distribution of the Residential and Agricultural Properties within 02 Km distance of Radius – Kurundugahahethekma Interchange

GramaNiladhari Division	No of Residential Properties	No of Agricultural Properties	No of Residential Properties within 02 Km distance of Radius	No of Agricultural Properties within 02 Km distance of Radius
Ella	202	147	82	57
IgalaThalawa	178	157	75	35
Kurundugahahethekma	139	112	111	18
Total	**519**	**416**	**268**	**110**

Source: D.S Office Reports, (2019).

Infrastructure facilities have also been developed in the surrounding areas along with the construction of the expressway. As a result, expressway interchanges have been developed recently. The distribution of land uses in Kurundugahahethekma Interchange is represented in the Figure 2.

Figure 2: Distribution of Land Uses in Kurundugahahethekma Interchange (within 02 Km Buffer Zone) Year 2019



Source: D.S Office Reports, (2019).

As per the figure 1 resdential areas were covered 32 percent and plantation and paddy areas were covered 53 percent from the buffer zone.

Results and Discussion

Interchanges in the Southern Expressway, land value varies due to many factors. Based on the Hedonic pricing model, identifies 6 independent variables which influences the land value. They are distance to the nearest town, distance to the nearest main road, distance to the nearest interchange, distance to the nearest hospital, distance to the nearest key school and distance to the nearest pocket bazaar. Descriptive statistics like mean values, then goes on to identify the impact of the interchanges on the land value variations using the Correlation analysis and the Regression analysis. Based on the land owners perception, the researcher identifies the impact of interchanges on land value variations of the selected interchanges in the Southern Expressway, through the data analysis by using frequency analysis, pie chart, paired sample t test

Table 2: Dependent and Independent Variables

	Minimum	Maximum	Mean	Std. Deviation
Land value per perch after interchange	45000.00	205000.00	117800.000	42901.814
Distance to nearest town	.20	1.60	1.143	.399
Distance to nearest main road	.05	3.00	1.422	.920
Distance to nearest interchange	.30	1.30	.699	.290
Distance to nearest hospital	.05	2.50	1.107	.774
Distance to nearest key school	1.00	3.30	2.081	.593
Distance to nearest pocket bazaar	.05	1.25	1.125	.547

Source: Analysis Data,(2019).

After the interchange, the land value of the area varies between Rs. 45,000 and Rs. 205,000 per perch. Mean value of land value per perch after the interchange has become Rs. 117,800. Land which was selected for the study, bears a distance between 200 m to 01.6 Km to the nearest town and the mean distance to the nearest town is 01.143 Km, distance to the nearest main road is in between 50 m to 03 Km and mean distance to the nearest main road is 01.422 Km, distance to the nearest interchange is in between 30 m to 01.3 Km and mean distance to the nearest interchange is 699 m, distance to the nearest hospital is in between 50 m to 02.5 Km and mean distance to the nearest hospital is 01.1075 Km, distance to the nearest key school is in between 01 Km to 03.3 Km and mean distance to the nearest key school is 02.0810 Km, distance to the nearest pocket bazaar are in between 50 m to 01.25 Km and mean distance to the nearest pocket bazaar is 01.1253 Km.

Identify the Relationship Between Land Value and Other Factor Around Interchanges Based on Hedonic Pricing Model

This section identifies the impact of the interchanges on the land value variations of the selected interchanges in the Southern Expressway based on the Hedonic pricing model using the Correlation analysis and the Regression analysis. There are two types of correlation analysis. Researcher has selected one of them by testing whether data set is normally distributed or not. If data set is normally distributed, then the researcher uses Pearson correlation analysis, if not the researcher uses the Spearman correlation analysis.

Table 3: Normality of Variables

	Skewness		Kurtosis	
	Statistic	**Std. Error**	**Statistic**	**Std. Error**
Land value per perch after interchange	.545	.241	-.369	.478
Distance to nearest town	-1.237	.241	.393	.478
Distance to nearest main road	.206	.241	-.907	.478
Distance to nearest interchange	.020	.241	-1.219	.478
Distance to nearest hospital	.400	.241	-.837	.478
Distance to nearest key school	.282	.241	.185	.478
Distance to nearest pocket bazaar	-.067	.241	-.013	.478

Source: Analysis Data, (2019).

Table 3 indicates that all variables were normal since the absolute values of skewness were between 2 and -2 and absolute values of Kurtos were less than 3. Thus, the researcher uses the Pearson correlation analysis.

Table 4: Correlation Analysis

		Land value per perch after interchange (Dependent Variable)
Distance to nearest town	Pearson Correlation	-.938**
	Sig. (2-tailed)	.000
Distance to nearest main road	Pearson Correlation	-.933**
	Sig. (2-tailed)	.000
Distance to nearest interchange	Pearson Correlation	-.652**
	Sig. (2-tailed)	.000
Distance to nearest hospital	Pearson Correlation	-.912**
	Sig. (2-tailed)	.000
Distance to nearest key school	Pearson Correlation	-.947**

	Sig. (2-tailed)	.000
Distance to nearest pocket bazaar	Pearson Correlation	-.959**
	Sig. (2-tailed)	.000

Source: Analysis Data, (2019).

There is a relationship between distance to the **nearest interchange and land value per perch**

H_0: There is no relationship between distance to nearest interchange and land value per perch

H_1: There is a relationship between distance to nearest interchange and land value per perch

According to the table Correlation significant value is 0.000; P value is less than 0.05. Therefore null hypothesis is rejected. Then with a confidence of 95%, there is a significant relationship between the distance to the nearest interchange and land value per perch. Pearson Correlation coefficient value is -0.652. According to the Pearson Correlation coefficient value, there is a significant moderate negative relationship between distance to the nearest interchange and land value per perch. Land value per perch decreases when the distance to the nearest interchange increases.

Regression Analysis

Land value variation and relationship with affected factors show in regression model as follows

$$LV = \beta_0 + \beta_1 DNT + \beta_2 DNMR + \beta_3 DNI + \beta_4 DNH + \beta_5 DNKS + \beta_6 DNPB + \varepsilon$$

LV: Land value per perch
DNT: Distance to nearest town
DNMR: Distance to nearest main road
DNI: Distance to nearest interchange
DNH: Distance to nearest hospital
DNKS: Distance to nearest key school
DNPB: Distance to nearest pocket bazaar

Table 5: Regression Coefficient

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	**Std. Error**	**Beta**	**T**	**Sig.**
1	(Constant)	226076.881	5352.644		42.236	.000
	Distance to nearest town	-54177.128	5476.768	-.505	-9.892	.000

Distance to nearest main road	-10827.331	2645.469	-.232	-4.093	.000
Distance to nearest interchange	-14363.915	3304.170	-.097	-4.347	.000
Distance to nearest hospital	-7375.636	2826.340	-.133	-2.610	.011
Distance to nearest key school	-32566.626	14199.422	-.451	-2.294	.024
Distance to nearest pocket bazaar	26684.812	16926.636	.340	1.576	.118

a. Dependent Variable: Land value per perch after interchange

Source: Analysis Data, (2019).

Distance to the Nearest Interchange has an Impact on Land Value

H_0: Distance to nearest interchange has no impact on land value

H_1: Distance to nearest interchange has an impact on land value

According to table 5.23, P value is 0.000; P value is less than 0.05. Therefore null hypothesis is rejected. Then with a confidence of 95%, the researcher can declare that the distance to the nearest interchange has an impact on the land value. Regression beta value for distance to the nearest interchange is -14363.915. Then researcher can say that the distance to the nearest interchange has a significant negative impact on land value. This is indicated by the following that is when thedistance to the nearest interchange increases by 01 Kilo meter, the land value will decrease by Rs. 14,363.915.

Therefore the distance to the nearest town, distance to the nearest main road, distance to the nearest interchange, distance to the nearest hospital and distance to the nearest key school has had an impact on the land value. Accordingly developed model for land value by using distance to the nearest town, distance to the nearest main road, distance to the nearest interchange, distance to the nearest hospital and distance to the nearest key school, as follows:

$$LV = 226076.881 - 54177.128\ DNT - 10827.331\ DNMR - 14363.915\ DNI - 7375.636\ DNH - 32566.626\ DNKS + \varepsilon$$

Regression beta value shows for distance to the nearest town, distance to the nearest main road is -54177.128. Then nearest town has a significant negative impact on land value, distance to the nearest interchange, distance to the nearest hospital, distance to the nearest key school shows negative relationship with land value.

Table 6: Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.987[a]	.974	.973	7050.04269	1.712

a. Predictors: (Constant), Distance to nearest key school, Distance to nearest interchange, Distance to nearest town, Distance to nearest hospital, Distance to nearest main road

b. Dependent Variable: Land value per perch after interchange

Source: Analysis Data, (2019).

R squared is 0.974. It means that 97.4% variation in land value can be explained by five independent variables such as distance to the nearest town, distance to the nearest main road, distance to the nearest interchange, distance to the nearest hospital and distance to the nearest key school.

Accordingly following facts concluded in the model.

- Distance to the nearest town has a significant negative impact on land value. When distance tothe nearest town increased by one Kilometre, land valuehas decreased by Rs. 54,177.12.
- Distance to the nearest main road has a significant negative impact on land value. When distance to the nearest main road increased by one Kilometre, land valuehas decreased by Rs. 10,827.33.
- Distance to the nearest interchange has a significant negative impact on land value. When distance to the nearest interchange increased by one Kilometre, land valuehas decreased by Rs. 14,363.91.
- Distance to the nearest hospital has a significant negative impact on land value. When distance to the nearest hospital increased by one Kilometre, land valuehas decreased by Rs. 7,375.63.
- Distance to the nearest key school has a significant negative impact on land value. When distance to the nearest key school increased by one Kilometre, land valuehas decreased by Rs. 32,566.626.
- Mean value of land after the interchange is greater than the mean value of land before the interchange. The land value has increased due to the interchanges.
- 59% of the landowners perceived that the value of property has increased as a result of the expressway. 91% of the landowners perceived that land demand has increased due to the interchange. 50% of the landowners perceived that the property value has enhanced as a result of proper accessibility through the expressway.

Conclusion

Studying the impact of interchanges on land use conversions and land value variations in the Southern Expressway is something of solid importance. The Government invests ample funds on expressways, with the intention of uplifting the living standards of the people. Therefore, studying the impact of interchanges on land use conversions and land value variations is an absolute requirement. Accordingly, the researcher identified two main objectives as research objectives. The researcher intended to ascertain the effect, the interchanges have had on the land use conversions of the Southern Expressway and also to see how it has influenced the land value variations in the Southern Expressway.

identify the impact of interchanges on the land value variations in the Southern Expressway (which is the second objective) based on the Hedonic Pricing Model, shows distance to the

nearest town, distance to the nearest main road, distance to nearest town, distance to the nearest interchange, distance to the nearest hospital, and distance to the nearest key school shows negative relationship with land value

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