Land Price Model For Sholinganallur Town In Chennai Metropolitan Area

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INTRODUCTION

Land is an immovable resource which helps to fulfill the basic needs of a human. Owning a land and house is a prestigious issue in the society and has become an investment option now. Effective usage of land becomes an integrated part of urban development. The urban based economic activities account for more than fifty percent of national Gross Domestic Product (GDP) in all the countries. In India by 2011, urban area will contribute sixty five percent to GDP. The agricultural land in 1980 was eighty four percent and it will be just thirty five percent in 2020 due to rapid urbanization. Present rapid growth overheated the economy and Information Technology (IT) development becomes the key factor in real estate activity. A buoyant economy, high disposable income, cosmopolitan atmosphere and improved life style become instrumentation for the demand of high rise apartments. India's urban housing demand was about 22.5 million in 2007 and it is expected to be 26.5 million in 2012. The real estate industry in India, which involves land and property emerged as a dynamic sector and its growth rose to twelve percent from seven percent in the past years.

Relaxation in Income tax act and financial act attracts Non Residential Indians (NRI) to invest in the real estate sector which yields a good annual return against a global average return. The number of transaction from 2003 - 2006 was remarkable in the Indian real estate market. During this period, residential value increased by more than fifty percent per year in all the locations of the city and in outer fringes, even though the area may not be accessed directly from road.

REVIEW OF LITERATURE

Many researchers have studied the modeling of land price using different methods of analysis and are briefly presented here. Rice (1992) developed a long-term economic model which demonstrated that real estate price were cyclically depressed by economic forces and it was also stated that economic model may explain the price in a good way. Nelson (1997) developed a least square regression model relating beltway with sales and service and found that more beltway has advantages. Tam et al (1999) identified environmental setting, accessibility, transport facility, school network, shopping facilities, and regional characteristics as variables affecting housing price. To characterize the relationship between accessibility, building age and housing price, the multiple regression analysis technique was employed. The analysis provided a quantitative technique for predicting the degree to which the changes in the dependent variable were related to the independent variable. According to this study, accessibility had no influence on housing price and the study explained with the R^2 of 0.62.

The cost of construction had dropped to eight percent in 1998 after a consecutive fourteen years rise in Hong Kong, which lead to the descend in land prices due to in-migration, which was reported in Hong Kong Hand book (1999). John (1983) showed the usefulness of time-series regression model, which used economic data to provide more accurate forecast of the land prices of Central Business District (CBD) in a moving market. Location, corner or non-corner, zonal character, employment and vacancy rate were identified, which explain up to eighty three percent of R^2. Agra CEAS (2001) constructed a land price model for England, Wales and Northern Ireland. The model consisted of data from 1973 to 2000, which was regressed against average gross margin. Land price was forecasted from 2001 to 2006 using auto regressive distributed lag model. With the model, the co-efficient, standard error and t-test were performed and found that the model explained with an R^2 of 0.9.

Buday (2005) developed the land price model for Slovakia. Five districts were studied in Slovakia and the land price in

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2001 and 2002 were compared. The area of sales were also compared and concluded that the price of agricultural land had sustained growth. Newton and Christian (2006) studied the life cycle cost of a building over its life span which included land acquisition, interest rate, design, construction and inspection cost, operation, maintenance and rehabilitation, administrative over head, demolition cost and availability of fund. The analysis was done using MINI-TAB statistical software to test correlation, analysis of variance (using general linear model) and regression analysis. Correlation between building age and quality was high and found that the cost of maintenance decreased if design quality increased. Kurnow (2007) studied the land value trend in the United States to trace the cyclic fluctuations in the distribution of land price among the States since 1922. There, the market value of a real property was derived by adding value of land with value of improvement.

Dianqing (2008) reported that if a piece of land cannot be developed within two years after being bought, it will be retrieved by the China Government for no compensation. Therefore, the real-estate developers cut down the housing price which leads to a decline to maintain the cash flow. It was also attributed by recent financial tightness. Population growth, urbanaisable area, excess liquidity, national growth rate, high inflation and interest rate were identified as factors for momentum in housing price.

From the literature review it is understood that more research work is needed to obtain a land price model with an R^2 value of more than ninety percent. Therefore, this study focuses on the modeling of land price using fundamental economic and physical factors.

ABOUT CHENNAI METROPOLITAN AREA (CMA)

Vision 2026 is to make Chennai a prime Metropolis which will be more livable, economically vibrant and environmentally sustainable. Chennai is the capital city of Tamil Nadu state and the forth largest metropolitan city in India. It is the place of focus for economic, social and cultural development. Chennai is situated on the Coramondal coast in South India and the land is a flat coastal plane, which is located with latitude between $12^{0}50'49"$ and $13^{0}17'24"$ and longitude between $79^{0}59'53"$ and $80^{0}20'12"$. CMA comprises of Chennai City Corporation, sixteen municipalities, twenty town panchayats, two hundred and four villages forming part of ten panchayat unions in Thiruvallur and Kancheepuram district. It extends over 1an area of 189 square kilometers. Population in 2001 was 7.04 million and it is expected to be 12.5 million in 2026. The density of Chennai ranges from 250 to 370 persons per hectare in many locations. Chennai is a major transport hub for road, rail, air and sea transport, connecting major cities both inland and abroad. Chennai is thus emerging as an important metropolis in the south Asian region. It is growing at a rapid pace and there is a demand for integrated development. Chennai is all set for making a quantum leap in automobiles, IT and telecom sector. The liberalization of Foreign Direct Investment (FDI) norms for investment in real estate, IT boom and up heated economy are the major factors that have pushed the Chennai urban development to a new high.

The city has dramatically changed over a period of time and mushrooming of commercial building is an outcome of the changing spatial dynamics. From 1994 to 2007, Chennai city's GDP grew at 6.5 percent, while the states GDP grew at six percent. The contribution of CMA to state GDP is forty percent. Chennai accounts for thirty percent of national auto industry, fifteen percent of IT industry and fifty percent of leather exports. From 2001, a number of multinational IT and BPO companies consider Chennai as a base for their operations. This increases the demand in IT space which over heats the real estate price. In turn, Chennai requires 30000 affordable houses per annum. The proposed Chennai metro rail has contributed a lot to the property and rental value that appreciated recently in Koyambedu and Anna nagar. The appreciation is relatively higher beyond Saint Thomas mount as outlying areas experience a higher rate of growth. Saint Thomas mount and Chrompet, which were purely residential areas, have now transformed into commercial hubs on account of the rail connectivity. The price rise per unit area is abnormal.

STUDY AREA

Sholinganallur, is located on Rajiv Gandhi Salai, which is one of the arterial roads in South Chennai, thirty kilometers away from the city center, and is the focus area of this study. The location of Sholinganallur in CMA is shown in the Figure 1. A width of 500 meters on either side of the old Mamallapuram road is declared as Rajiv Gandhi Salai, which is a twenty kilometer stretch with 290 crores of investment from Madyakailash to Sirucherry with six lanes of carriage way. The corridor is dotted with a number of leading software companies and a host of educational institutions. Now, 35000 vehicles are plying on the road daily. Large expansions in the technology sector are underway along this

corridor. The widened road, optic fiber network and expected rail network accelerate the development. The growth of IT industries in this corridor has been attracting a mix of people from other states as well as from abroad.

The IT corridor is filled with several IT parks, has high density of housing and community amenities such as shopping malls, multiplexes, health clubs, schools, cultural community halls, hospitals, star hotels, children parks and convenience stores. The IT corridor has triggered unpredictable development in real estate. Out of eighty IT parks whose construction is underway all over the city, fifty are built on IT corridor, among which, ten are at Sholinganallur. Infrastructure development is the key for the growth of IT corridor which is equipped with under ground utility trenches for electrical, water and sewage system. Population growth in Sholinganallur recorded a moderate average growth of 4.5 percent from 1971 to 2001.

Table 1 : Multiples of Land Prices at Sholinganallur

Year	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999
1999	7.8	6.7	6.0	4.1	1.8	1.2	1.1	1.1	1.0	1.0
2000	7.5	6.5	5.8	4.0	1.8	1.2	1.1	1.1	1.0	
2001	7.1	6.1	5.4	3.7	1.7	1.1	1.1	1.0		
2002	6.6	5.7	5.1	3.5	1.6	1.0	1.0			
2003	6.2	5.4	4.8	3.3	1.5	1.0				
2004	4.1	3.6	3.2	2.2	1.0					
2005	1.8	1.6	1.4	1.0						
2006	1.3	1.1	1.0							
2007	1.1	1.0								
2008	1.0									

Fig.1: Location of Sholinganallur
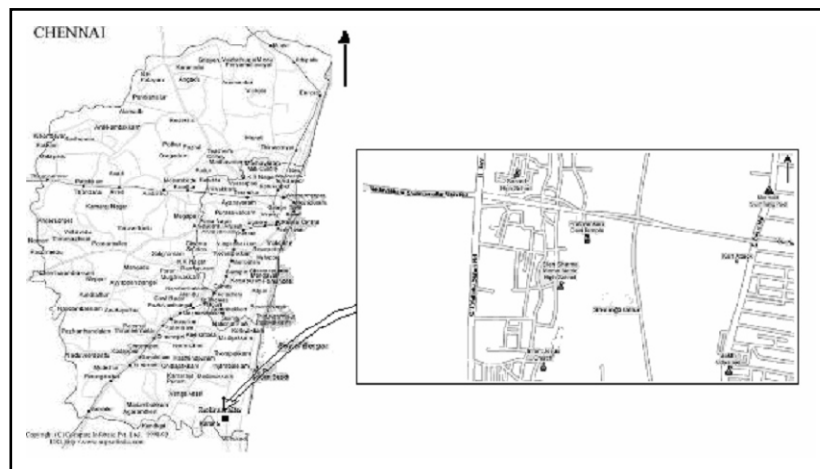
Sholinganallur is a division under Saidapet Taluk which bears a village number 189. It is having an area of 15.35 square kilometers. The pattern of land use consists of primary residential 0.5 %, mixed residential 0.5 %, light industry 1 %, general industry 27 % and open space of 71 %. Sholinganallur has become the heart of IT corridor, which has a four arm intersection having connectivity to many sub-urban areas like Tambaram in the West and Thiruvanmiyur in the East. It has a very high demand of residential units and lack of it leads to peak rental value. Major IT industries, third diary milk products industry, famous religious temples and industrial electrical supply terminal are the assets of Sholinganallur. ELCOT has proposed the construction of a Software Technology Park of over 50 acres in Sholinganallur. The first phase of Knowledge Industrial Township is also planned at Sholinganallur to meet the increasing demand for IT Parks and it is initiated to establish Tidal Park-II in Chennai. A new bus terminal is proposed at Sholinganallur and the fund has been allotted by the Tamil Nadu Government. These proposals on new developments may make Sholinganallur as a national focus of productivity.

ANALYSIS

The analysis comprises of Chi-square test, regression model and annual factor model. The relationship between various factors was investigated for the study area. The investment made on land at Sholinganallur from the year 1999 to 2008 is tabulated as multiples in Table 1. It is observed that there is a significant land price rise from the year 2005. The annual growth of investment made in fixed deposit, gold and land at Sholinganallur is collected consecutively for five years and is given as percentage in Table 2. The investment made on land yields maximum benefit for the investors when compared to investment on fixed deposit and gold. However, the investment on gold shows stable and steady growth.

Table 2 : Yield From Various Investments In Percentage

Period	On fixed deposit	On gold	On land
Jan.2004 (1999-2003)	8.6	9.2	25
Jan.2005 (2000-2004)	7.8	8.8	36
Jan.2006 (2001-2005)	7.1	13.5	75
Jan.2007 (2002-2006)	6.7	16.1	102
Jan.2008 (2003-2007)	6.7	15.2	108
Jan.2009 (2004-2008)	7.3	17.5	83

Chi-Square test is performed to determine whether the two attributes are independent of each other. Here, the yearly unit price of land and the average land piece of past 12 years (1997 - 2009) were treated as two attributes

$$\chi^2 = \Sigma \, (\theta_i - E_i)^2 / E_i \qquad ----------------- \ (1)$$

Where,

θ_i = Price of land in a specified year,

E_i = Average of land price over 13 years.

The Chi-Sq. test result in the study area is greater than the standard table value which corresponds to 12 degrees of freedom and 5 % error significance ($\chi^2_{0.05,12}$). The calculated Chi-Sq. value is not within the acceptance region. Therefore, the null hypothesis is rejected and the evidence supports the acceptance of alternate hypothesis which implies that the price rise is significant and the two attributes are dependent on each other. To measure the degree of association between two sets of variables, and to measure the magnitude of linear relationship of land price (Y) on

Table 3 : Interaction Effect Of Factors On Sholinganallur Land Price

Factors	Correlation coefficient
Width of road	0.97
FSI	0.92
Distance from terminal	0.99
Time	0.96
Dollar equivalence	0.51
Silver price	0.97
Inflation	0.54
Crude oil price	0.97
Mumbai sensex	0.98
National sensex	0.97
Construction cost	0.92
Guideline value	0.76
Population	0.88
GDP	0.54
Gold price	0.97
Home loan interest	0.31

individual factor (X), correlation analysis was performed. Correlation Analysis is a statistical tool, which is used to determine the degree of which one variable is linearly related to another. The interaction effect of various factors on Sholinganallur land price is estimated and is shown in Table 3. Home loan interest shows the least correlation with the land price.

MODELING OF LAND PRICE AT SHOLINGANALLUR

Generally, the annual growth of land price is significantly influenced by price of gold and status of equity market, which acts as alternate options of investment. Hike in crude oil price lifts inflation and drags national economy. Dollar rise weakens Indian currency and drags the cost of gold. Gold gains on minimum rate of interest on fixed deposit and weak share index. Weak share index downs the value of currency and raises inflation and interest rate on home loans. The rise in inflation further drags the share index, lifts interest rate on home loan and cost of construction. Rise in inflation and cost of construction along with the rise in interest rate on home loan will weaken the economy and drag down the affordability of people. Poor affordability pulls down the realty sector. The downturn realty sector leads to falling of land and property price. The consumption of land cycle depends on low inflation, realistic realty price and low interest on home loan. If the factors are under control, the cycle will start again.

The economic factors such as price of crude oil per barrel in dollars, gold and silver per gram in rupees, national GDP in percentage, Mumbai and National Share Index and, national inflation in percentage, interest rate on home loan in percentage and cost of construction per square feet in rupees and social factors such as guideline value of land in study area in rupees, population in numbers and the time factor are collected as monthly average from 1997 to 2009. The factors have inter-correlation with each other and have negative and positive impact on land price which are modeled by developing a multiple Step-wise regression analysis using Statistical Package on Social Science (SPSS) software. The land price per 5.5 cents is treated as a dependent variable and the above said factors act as independent variables. Both forward and backward analysis are performed with 95 % confidence level and 5 % error significance level among which, backward analysis explains the trend very closely with a R^2 of 0.98. The model neglects some of the factors such as dollar, GDP, gold and construction cost, which have negligible response with land price. The significance error of factors on the model is shown in the Table 4. Table 5 showed the response of models with the real trend of land price by performing analysis of variance.

Table 4: Factors And Error Significance

Factors	Error significance
Time	0.00
Dollar equivalence	0.06
Silver price	0.00
Inflation	0.04
Crude oil price	0.00
Mumbai sensex	0.03
National sensex	0.00
Construction cost	0.06
Guideline value	0.02
Population	0.00
GDP	0.40
Gold price	0.19
Home loan interest	0.06

Table 5: Model Summary And ANOVA

Description	Sholinganallur
R	0.993
R^2	0.986
Adjusted R^2	0.984
Sum of square	6.830E14
Degree of freedom	13
Mean square	5.254E13
F	689.673
Sig.	0.000
Dependent variable: Market price of land (₹)	
Predictors: Constant, Guide line value (₹), Year & Month, Population, BSE Index, NSE Index, GDP (%), Inflation (%),Crude oil ($),Gold price (₹), Silver price (₹), Dollar Equ. (₹), Cost of construction (₹),.Home loan interest (%),	

The land price model in rupees at Sholinganallur derived from the multiple step- wise regression analysis is given below:

Land price of 5.5 cents in Sholinganallur = 378700000 - 5.738 * Guide line price (₹) + 438.012 * Population in numbers + 128895.22 * Inflation (%) + 166121.85 * Home loan interest (%) + 59049.346 * Silver price (₹) - 26954.802 * Crude oil price ($) + 94.565 * BSE Index + 493.849 * NSE Index (%) - 193180.217 * Time.

Table 6 : Physical Factors of Sholinganallur

Road	Zone	Road width (m)	FSI	Distance from terminal (km)	Land price (Lakhs)
Devaraj nagar	Residential	7.50	1.50	0.50	72.5
Padavetamman street	Residential	5.20	1.50	0.70	30
MGR street	Residential	8.20	1.50	0.60	45
Govindan street	Residential	7.00	1.50	0.60	40
Ponniamman street	Residential	7.50	1.50	0.80	42
Wipro road	Commercial	13.30	4.00	1.00	140
OMR	Commercial	50.30	4.00	0.20	165

The behaviour of market price and the derived model price in Lakhs at Sholinganallur is shown in Figure 2. It can be seen that the difference in land price is about six percent. This shows the efficiency of the derived model.

Fig.2: Behaviour of Market Price and Regression Model Price
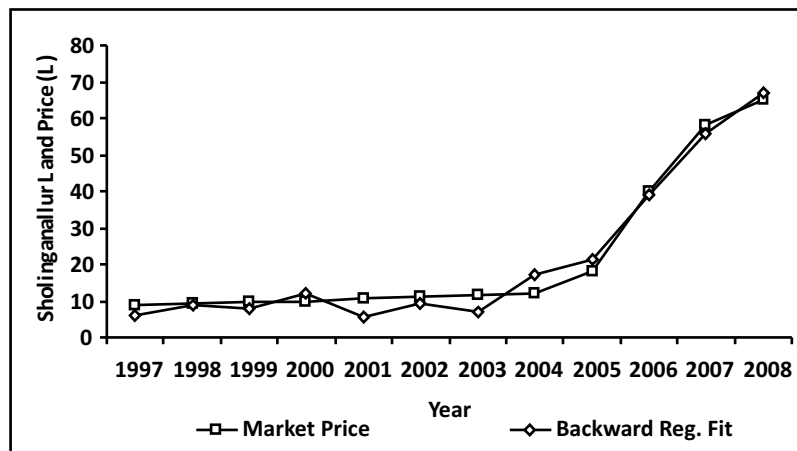
FORECASTING THE LAND PRICE AT SHOLINGANALLUR

The land price at Sholinganallur is analyzed from the year 1997 to 2009 and the influence factors are identified. The land price is forecasted for the year 2010 using backward step-wise regression model with an R^2 of 0.98. For the year 2009, both the model and real value shows somewhat same behaviour in the model validation and for the year 2010, the model shows a 20 % increase in price which is shown in Figure 3. The rise in the trend shows the healthy market which may be due to the higher trend of fundamental economic factors.

Fig. 3: Forecasted Land Price At Sholinganallur
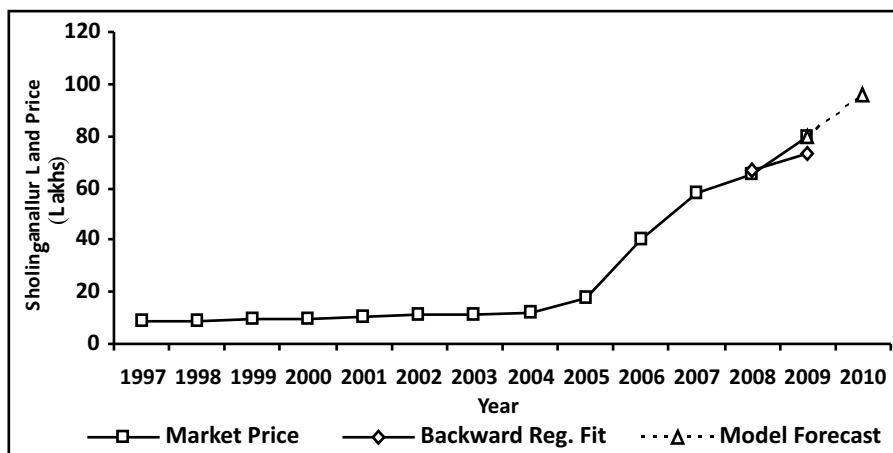
MODELING OF LAND PRICE AT SHOLINGANALLUR WITH PHYSICAL FACTORS

The behavior of land price along the selected roads at Sholinganallur in the year 2008 is shown in Table 6. Some of the physical factors considered in the study area are width of road, Floor Space Index (FSI) and distance from Sholinganallur junction. The relationship of land price with road width is shown in Figure 4. From the analysis it is observed that the impact of road width on land price is more than that of other factors. The land price increases when the width of abutting road increases and the behaviour is reversed with respect to the distance from the terminal as shown in Figure 5.

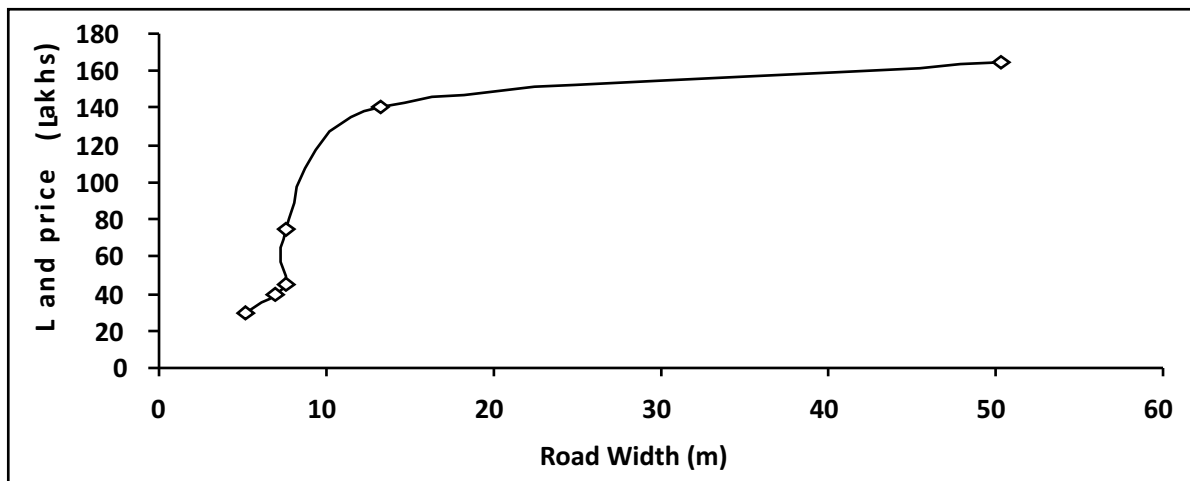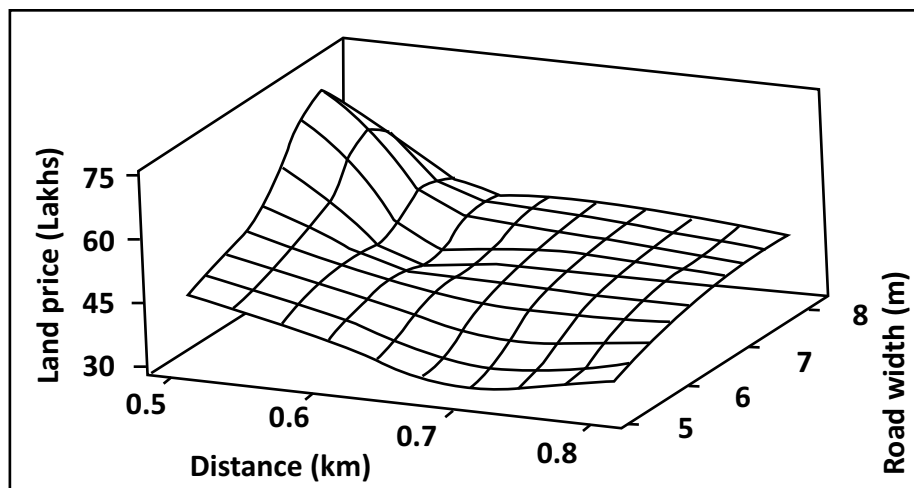**Fig.4 : Relationship Of Road Width To Land Price In 2008**

Fig.5 : Relationship Of Distance Form Terminal, Width Of Road And Land Price

Annual factor model on land price in lakhs is derived for Sholinganallur for the year 2008 by Factor analysis using MINI-TAB statistical software. The derived model is:

Land price of 5.5 cents in Sholinganallur = 448.92- 37.555 * road width - 106.92 * FSI - 413.77 * distance from terminal + 8.294 * road width * FSI + 44.419 * road width * distance form terminal.

The model is well suited along the commercial roads and negligible difference is found along residential roads. This annual model can be used to assess the market price of any parcel of land in the study area with known width of road, permissible FSI and measured distance from terminal location.

CONCLUSION

The land price at Sholinganallur is modeled using identified economic factors. From the analysis, it is concluded that nine out of thirteen factors are significant determinants on land price. The regression model, which accounts for ninety eight percent variations in the land price, is applied to determine the future land price. The annual factor model on land price with physical factors will help to justify the price of any parcel of land in the study area.

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