Development of Property valuation model Using Geospatial Techniques

Dr. GOPAL M. NAIK
Associate Professor of Civil Engineering Department,
University College of Engineering, Osmania University, Hyderabad, India
(Email:mgnaikc@gmail.com)

Abstract : Urban environment basically consists of built up area, such as buildings, roads, industries, business areas, parks etc., and the natural features like vegetation cover, soil and water inside urban activity zone. The stepwise multiple regression method is used in this study, which have the advantage to include the most significant variables in the model and makes the model simple. The valuation model describes the relationship between physical and locational characteristics of property, and its value. Through this study models are developed for residential property of GHMC integrating self declared and field data from three neighborhoods. The additive type model structure has been used in this study and the statistical tests show that, this type of model is well fit to the residential properties valuation. This study highlights how the modern technology can be used in the study of urban and its growth trend, updating and monitoring using repetitive coverage, urban environment especially changes in the property value. The aim of the study is to describes the analysis of property tax, which plays a major revenue to increase the financial sources of Greater Hyderabad Municipal Corporation (GHMC), Hyderabad. The prevailing methods of property valuation are lack of rationalization and standardization that is, the rate of taxation varies from house to house within and between areas, although houses are of same type and market rates are similar. This study shows that, the important characteristics of property to determine the value in GHMC are: condition of buildings, total floor area, number of rooms, and date of valuation. GIS has become an important and useful tool with multiple regression analysis to develop the valuation model.

Keywords: Property Valuation Model, Urban Planning and Development, Geospatial techniques.

About the Author:
Dr. Gopal M. Naik Working as Associate Professor of Civil Engineering Department, University College of Engineering, Osmania University, Hyderabad. He was graduated in Civil Engineering from Osmania University in 1995. He has obtained his Master’s degree (M.E.) in Water Resources Engineering and Management in 2001 from Osmania University. He obtained his Ph.D. degree from Department of Civil Engineering, Indian Institute of Technology Bombay in 2009. From 1996 to 1998 he was worked as Associate Lecturer at Govt. Model Residential Polytechnics, Srisailam, Andhra Pradesh. He involves in many administrative position in the College as well as in the University.

Dr. Gopal M. Naik, M.E., Ph. D. (IIT Bombay)
Associate Professor of Civil Engineering,
University College of Engineering (Autonomous)
Osmania University, Hyderabad-500007, A.P.
E mail ID: mgnaikc@gmail.com
Contact No: +91 – STD Code : 040
Phone: 27097125 (M):+91-9490685098
Fax:040-27095179
Introduction

Rapid urban development and increasing land use changes due to population and economic growth in selected landscapes is being witnessed of late in India and other developing countries. The cities are expanding in all directions resulting in large-scale urban sprawl and changes in urban land use. The spatial pattern of such changes is clearly noticed on the urban fringes or city peripheral rural areas, than in the city centre. In fact, this is reflected in changing urban land use patterns. There is an urgent need to accurately describe land use changes for planning and sustainable management. In the recent times, Remote Sensing and Geographical Information System is gaining importance as vital tool in the analysis and integration of spatial-temporal data. The urban areas in the developing world are under constant pressure of a growing population. Efficient urban information system is a vital pre-requisite for planned development. The increasing demands in urban planning and management sectors call for co-ordinate application of Remote Sensing (RS) and Geographic Information System (GIS) for sustainable development of urban areas. There is an urgent need to adopt Remote Sensing and Geographic Information System approach in urban development and monitoring process for implementing pragmatic plan of urban development. The plan must incorporate an integrated approach of spatial modeling using Remote Sensing Data, GIS database and GPS solutions. Municipalities worldwide have realized the need for GIS to assist with effective planning and decision support. The lack of technical resources coupled with the complexity of GIS technology has meant that many systems do not deliver on the promises made and typically take years before they deliver any results.

Property Tax and Valuation Analysis

The primary role of property taxes is to provide a local source of revenue to finance municipal services. Property taxes include a variety of taxes on land, buildings and other immovable property both principle and practice, property tax can have important fiscal and non-fiscal effects. In turn, the extent to which the local governments have control over property taxes is often an important determinant of the extent to which they are able to make autonomous expenditure decisions. At least four characteristics of the property tax differentiate it to some extent from other taxes: its visibility, its inelasticity, its inherent arbitrariness and the extent to which it reflects local autonomy.

Property Taxation:

Property taxation is a value based tax. It is based on the principal that the amount of tax paid should be based on the value of property owned. There are two basic forms of property taxation: the property tax may be levied on the annual or rental value of the property, and the capital value of land and improvements. The annual or rental value system is the property assessment according to some estimate of rental or net rent, whereas the capital value system is based on market price. The property tax is regarded as the fairest possible tax (Eckert et al., 1990). The property tax is difficult to administer, especially in developing countries. Because the quality of tax administration is poor, the burden of the tax falls haphazardly on those to exploit its weaknesses (Dillenger, 1992).

Tax Assessment:

The assessment function is the integral part of a property tax structure. The terms assessment and assessed value are often interchangeable (Eckert et al., 1990). Assessment may refer to the assessed value of a single parcel of property, the total
assessed value of all properties within the boundaries of tax jurisdiction, or the assessed value of group of properties. Assessed values of property are usually based on the appraised value of property. The appraised value of property is an appraiser’s judgment as to the full market value on a specific appraisal date. According to various laws, the assessed value of property for tax purpose must represent either the full fair market, or cash, value of the property or a specific percentage of such value. Whether assessments are at full value or a proportion thereof is usually a constitutional or legislative policy decision, not an administrative one.

**Property Valuation:**

Property value can be denominated in two ways: either on the basis of the rent of the property would be expected to yield (its annual rental value or ARV) or according to its expected sales price (termed capital or market value). Both definitions are widely used. The choice of a system is largely a reflection of historical association as the United Kingdom and France, in general, their one-time colonies in Asia and Africa have traditionally valued property on the rental value basis and countries influenced by the USA have defined value on the basis of capital value. In practice, the economic consequences of two definitions are not as different as theory would suggest (Eckert et al., 1990). The purpose of tax valuation is to provide a basis for distributing the burden of property tax. It requires only a determination of relative value of properties at a common point of time. In mass appraisal many people work on the process and this requires synchronization of both task and appraisal judgments. It requires standardized procedures across many properties. Thus, valuation models developed for mass appraisal purposes must represent supply and demand patterns of group of properties rather than a single property. Valuation accuracy can be improved through 'mass appraisal' which is formula-driven valuation method that minimizes reliance on the judgment of values and the honesty of taxpayers (Dillinger, 1992). Mass appraisal techniques emphasize equations, tables, and schedules, collectively called models constructing such models can be viewed as a two-step process i.e. specification of the basic model structure and model calibration. Property valuation is the process of identifying and qualifying the value factors. The property characteristics, location, construction cost, rent, sale price etc. are factors, which contributed to the valuation. The collection and analysis of these evidences of values are crucial to accurate property values and thus an effective assessment system. Comparable evidence is fundamental to all valuation methods. A lack of data is a significant factor affecting property valuation (Wyatt, 1997).

The determination of the property tax depends on the correct, appropriate and up-to-date information and data on property. In present system, the main data for valuation come from tax-payer returns and field survey. In these processes large amount of spatial and non-spatial data are handled. But there is no system or procedure to verify and identify accurately the quality and quantity of data used. As a result the property tax is associated with the fact that the assessed value is an imperfect estimate of the annual rental value, based on rather limited information. Consequently, the valuation system is confusing in individual cases, particular in case of owner occupying houses, especially in areas with few comparable prices. Therefore, a need is felt to use an assessment procedure that reduces such risk. However, property valuation, requires a wide range of data (such as cadastre, land use, building) from different sources, collected and maintained independently in different departments or organizations. But in the present assessment system, it is not possible to identify, qualify and quantify all available information from different sources and keeping it up to date. So, in this research, the aim is to develop a valuation procedure for residential property tax
assessment in GHMC within mass appraisal system using GIS which can integrate process and update a large amount of data from different sources.

Utility of Geospatial Techniques

Due to the rapid course of urbanization, the haphazard growth of major cities is one of the challenging situations in front of any country. As unorganized urbanization is becoming the major problem, it requires the immediate solution for sustainable development of urban land. In the emerging scenario it is essential to have updated information on urban growth patterns and its impact on the living environment. The growth and development of cities are likely to continue and therefore there will be a need for proper planning and managing or improving the existing infrastructure facilities. In this juncture, the state of the art technologies Remote Sensing and Geographic Information System can play an imperative role. Hyderabad Metropolis is one such rapidly developing city in Andhra Pradesh. This work explores the study of Urbanization growth of Hyderabad city using geospatial techniques like remote sensing and Geographical Information System.

Real time traffic data combined with accurate maps can be very effective in reducing the response time for emergency services also GIS can help determine spatial and temporal distribution of natural resources and type of activities that are damaging the natural wealth of the nation. With this information the authorities can take pre-emptive steps in specific regions to promote the cause of conservation of natural resources. Similarly spatial demographic information combined with land usage can be used to determine the land price hike and for setting the economic policies of the region. GIS can help in providing information about crime rate and types of crime in the various city-sectors and in different cities. This information should be mapped and made available on the internet. This would make people aware and help them take judicious decisions about their movement across different parts of the nation. Several cities across the world provide regional crime database to citizens. Making such information publicly available also promotes competition among the authorities of different cities, because best talent and companies would like to establish themselves in the safest cities. GIS and remote sensing techniques can also help in tackling problems related to traffic, encroachments, air and noise pollution water and power supply, property valuation etc. If the relevant spatial information is made available to the planners, they can take much better and fine grained policy decisions to solve these problems (Adams, 1994).

The base map will be the base for infrastructure development for urban or town planning areas in the urban cities. This base maps are updated with the cadastral map, master plan, approved layout village boundaries to create Geo-data base. Figure 1 shows the flow chart of utility of remotely sensed data and Geographical information system. Hence, in order to use land optimally, it is not only necessary to have the information on existing land use land cover but also the capability to monitor the dynamics of land use resulting out of both changing demands of increasing population and forces of nature acting to shape the landscape. Thematic maps have been generated for the study area, which is optimally suitable to the terrain and to the productive potential of the local resources so that the level of production is sustained without decline over time.
Figure 1. Flow Chart showing the utility of Remote Sensing and GIS

Study Area Description

The Greater Hyderabad Municipal Corporation (GHMC) earlier known as the Municipal Corporation of Hyderabad (MCH) is the urban planning agency that oversees Hyderabad, the capital and largest city in the Indian state of Andhra Pradesh. Its geographical area covers most of the urban development agency the Hyderabad Metropolitan Development Authority (HMDA). The Greater Hyderabad Municipal Corporation was formed on 16 April 2007 by merging 12 municipalities and 8 gram panchayats with the Municipal Corporation of Hyderabad. The study area for the development of Property Valuation Model is for Ward-87 (Nallakunta), which is located in the central Zone of Greater Municipal Corporation of Hyderabad with dense population and urbanization as shown in Figure 2.

Figure 2. Shows the study area of central zone of GHMC Nallakunta.
Nallakunta:
Nallakunata area is one of the prime residential area of Hyderabad and covers to an extent of 0.40 Sq.Km. Most of the houses are four to six storeys with good quality. This area is established as a planned residential area. Roads are mostly straight and widening from 10m to 30m and field, park, open space, recreational and lake area is about 37%. All types of services such as electricity, water, gas, telephone, sewage are available and infrastructures of in good condition in this area. The inhabitants of this area are upper and upper-middle class people. The area is bounded on the north by Bagh Lingampally, on the east by vidyanagar, on the south by Golnaka and on the west by Barkatpura. The area is well developed in the fields such as road network, residential building, and commercial activities and with all the amenities.

Generation of Thematic Maps
The Greater Hyderabad map is obtained from the Remote Sensing Image from the CARTOSAT-1 Satellite Sensor with Resolution of 2.5m. Thematic maps have been generated for the study area, which is optimally suitable to the terrain and to the productive potential of the local resources so that the level of production is sustained without decline over time. The integration of the aforesaid aspects, through very complex is achieved systematically. The theme maps digitally prepared are studied in combination. The study of thematic maps in combination helps in better understanding of the cause and effect in respect of a problem and limitations, and also about the potential that exists in the study area.

Road Network area boundaries
The Road Network area boundaries have been prepared from the toposheet map of 1:50000 scale and the localities, land marks has been integrated using ArcGIS, Arc/Info software and the relevant data is processed in order to extract the information required by road network evaluation indicator system. Figure 4 shows the road network map of Ward-87, Circle-09, Central Zone, GHMC, Hyderabad.

Land use / Land Cover
The Land use / Land cover maps are prepared by visual interpretation techniques. The base map prepared from Survey of India toposheet map of 1:50000 in the placed on the IRS geocoded on 1:50000 scale and keys of image interpretation are used for preparing the land use/land cover for the study area. Further, sufficient Ground reality is essential for an accurate land use / land cover
mapping. GIS can also calculate the degree of purity (namely occupancy rate) of specified land-use in the land-use zoning. By overlaying building-use present condition map on each of eight types of digital land-use zoning maps, the buildings that do not match with the specified land-use in the zoning system can be retrieved. GIS can achieve spatial analysis on maps efficiently and offer scientific tools for urban planning. The Land Use / Land Cover Map of Ward-87, Crcle-09, Central Zone, GHMC has shown in Figure 5.

![Figure 5. Land Use / Land Cover Map of Ward-87, Crcle-09, Central Zone, GHMC](image1)

**Total Floor Map**
The Total floor area maps are prepared by visual interpretation techniques. The base map prepared from Survey of India toponmap of 1:50000 in the placed on the IRS geocoded on 1:50000 scale and keys of image interpretation are used for preparing the land use/land cover for the study area. Further, sufficient Ground reality is essential for a Total Floor mapping. The Physical verification has been carried with a team of experts and data such as House numbers, Number of floor map of Ward-87, Circle-9, Central Zone, GHMC has been prepared and shown in Figure 6. The study area is mostly a residential area with minor commercial zoning. The above data has been obtained from the data base of GHMC and mapping has been made along with field survey by collected data samples of study area for development of property tax valuation model.

![Figure 6. Total Floor Map of Ward-87, Circle-9, Central Zone, GHMC](image2)
Methodology

Property taxes include a variety of taxes on land, buildings and other immovable property both principle and practice, property tax can have important fiscal and non-fiscal effects. In turn, the extent to which the local governments have control over property taxes is often an important determinant of the extent to which they are able to make autonomous expenditure decisions. The research methodology and details of the methods used in data collection, data measurement and data analysis needed to accomplish the research objectives. Technological advances have facilitated the process of information gathering, storing, handling and utilization. The statistical parameters and other techniques used to analyze the data. The empirical part of this study; the valuation model is developed using Multiple Regression Analysis (MRA) in SPSS software and other statistical analysis of data is done to achieve the research objectives. MRA measures the relative influence of independent variables on a dependent variable. In MRA a dependent variable is regressed against the set of independent influencing variables. The model is tested with various parameters including coefficient of determination, coefficient of correlation, unstandardized coefficients, standardized coefficients and statistical tests.

Types of Data Collection

This step consists of extracting data from the official's documents and other sources. Total 450 properties data has been collected from the property tax registers of GHMC, which are in the time period from 1999 to 2009. In the property registers information is gathered from the self declaration of property owners and also from field data collection by Tax Inspectors and Bill Collectors of revenue department. During the general assessment in 1999s, self-declared data were used for valuation purposes other than field data were collected from spot verification for valuation. The primary and secondary data were collected for the study as shown in Figure 3 Flow chart for method of data collection.

Primary data collection:
The primary data is collected from the officials and property owners through meetings and interviews. These interviews and meetings were conducted using selected questionnaires to collect information about the present valuation system, its merits and demerits, problems, and user needs with regards to valuation of property.

Secondary Data collection:
The field work was carried out for data collection selecting three localities in Ward No.87 of GHMC as study area. The secondary data about property were collected from property registers of Revenue Department of GHMC, which were gathered from self declaration and field data collection. Table 1 shows the types of collected data and Figure 4 shows the pie chart field collected and self declared data.
Figure 3. Flow chart showing the method of data collection

Figure 4. Pie Chart shows the Collected Self declared and Field data.
Table 1. Types of Collected Data

<table>
<thead>
<tr>
<th>Data source</th>
<th>Nallakunta</th>
<th>New Nallakunta</th>
<th>Tilak Nagar</th>
<th>Overall study area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self declaration</td>
<td>37.33%</td>
<td>38%</td>
<td>58%</td>
<td>200</td>
</tr>
<tr>
<td>Field data</td>
<td>62.67%</td>
<td>62%</td>
<td>42%</td>
<td>250</td>
</tr>
<tr>
<td>Total number Of samples</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>450</td>
</tr>
</tbody>
</table>

**Data examination:**

In this step the collected data are examined to understand and learn the meaning of the attribute of property. In the property registers of the following information are recorded; holding number, Owners name, road / muhalla name, ward number, ward name, property type, nature of construction, condition of building, number of room, number of bathroom, total floor area (in sqft), number of storey, date of valuation, annual rental value (in Rupees). All these information were collected during field work.

From the collected information the following attributes are selected to build the models of valuation in chapter five:

**Nature of Construction (NAC):**

The quality of the construction, according to internal standards of the in a four level categorization. They are: RCC-P, Buildings, which are fully made of concrete with good finish; RCC-O, Buildings constructed with concrete with average finish; CTB, Buildings constructed with Country Tiled Roof; MTB, buildings constructed with Medium or kutcha roof; or other materials. Property is evaluated during the official inspection, and also come from self declare form, and the conferred category is recorded in the property register.

**Condition of Building (COB):**

The overall quality of a property is described in the property register. This is done at the time of inspection of the houses by the staffs of GHMC and also from the self declaration. There are four level of qualifications are designated according to GHMC’s internal standard and those are: good; construction condition is well and fixture-fittings are fully equipped, fair; construction and fixture-fittings are reasonably good, average; construction condition and fixture-fittings are old, and poor; construction condition is very old and quality is bad. This data is collected as COB.

**Number of Rooms (NOR):**

Total number of rooms in a property is recorded in the register. This data is collected as NOR.

**Total Floor area (TFA):**

Total space of dwelling area of a property used by inhabitants, which is measured in square feet. This attribute is collected as TFA.

**Number of Storey (NOS):**

Total number of storey (i.e. floors) of a property is recorded in the register. This data is collected as NOS.

**Date of valuation (DAV):**

In the property register the date of imposing the tax is recorded and which is collected as DAV.

**Assessed annual rental value (ANV):**
The assessors assess the annual gross rent of the property. They assess the gross ten months rent as the annual rental value. The value is given in Rupees. This attribute is collected as ANV. The coordinates of the property (X, Y): The spatial position a property, in terms of a regular grid.

**Development of Additive Multiple Regression Model**

The Additive Multiple Regression Model (AMRA) has been developed and used in the present study. The objective of AMRM, as applied to mass appraisal, is to model the relationship between property characteristics (independent variables) to property value (dependent variable), so that the latter can be estimated from the former. The goal of modeling is to explain a lot with a little. From the basic model types, we use variables that were thought to influence value in the study area. So, the general structure of property valuation model can be formulated as follows:

\[ Y = b_0 + b_1 \text{NOR} + b_2 \text{NOB} + b_3 \text{TFA} + b_4 \text{NOS} + b_5 \text{NAC} + b_6 \text{COB} + b_7 \text{DAV} \]  

Where, \( Y \) is the estimated value of the property; the dependent variable \( b_0 \) is the constant and \( b_1 \) to \( b_7 \) are the regression coefficient of independent variables. The independent variables are NOR- is the number of rooms, NOB- is the number of bathrooms, TFA- is the total floor area, NOS- is the number of storey, NAC- is the nature of construction, COB- is the condition of the building, DAV- is the date of valuation

**Evaluating and interpreting AMRM model:**

The AMRM mode is evaluated by eight statistics. Four are measures of goodness of fit and relate to evaluation of the predictive accuracy of the equation. They are the coefficient of determination \( R^2 \), the standard error of estimate (SEE), the coefficient variation (COV) and the average percent error. In different ways, each indicates how well the equation succeeds in minimizing \( e_i \)

Where \( e_i \) is the \( i \)th residual the difference between the observed and predicted response and is expressed as:

\[ e_i = y_i - \bar{y} \]  

where \( y_i \) is the observed value and \( y \) is the predicted value of the given sample.

**Coefficient of determination \( R^2 \):**

The coefficient of determination (COD) or the squared multiple correlation; \( R^2 \) is the sum of squares model (SSM) / Sum of squares total (SST) is the proportion of variation of the response variable \( y \) that is explained by the explanatory variables \( x_1, x_2, \ldots \) in a multiple linear regression.

\[ R^2 = \frac{\Sigma(\hat{y}_i - \bar{y})^2}{\Sigma(y_i - \bar{y})^2} \]  

The COD is the percentage of variance in property values explained by the regression model. The \( R^2 \) statistic ranges from 0.00 to .1.00, Small value indicates that the model does not fit the data well. On the other side, when \( R^2 \) equals 1, all variations in values are explained by the regression equation. If \( R^2 \) equals 1 in a one variable model, it means if value is plotted against the variable, all values would lie on a straight line.

**Standard error of the estimate (SEE):**

The standard error of the estimate measures the amount of deviation between actual and predicted property value. It is computed as:
Where \( n \) is the number of observations and \( p \) is the number of independent variables. The SEE is the sum of squared errors divided by its degrees of freedom \((n - p - 1)\). This yields a measure of the squared error or variance of the regression model. The SEE is calculated in a manner that analogous to the standard deviation, and indeed can be viewed as the standard deviation of the standard errors. Thus, if the errors are normally distributed, two-thirds of actual values will fall within 1 SEE of their predicted values, 95 percent within 2 SEEs and so on.

**Coefficient of correlation (R):**

The square root of \( R^2 \), called multiple correlation coefficient, is the correlation between the observed value \((y')\) of the dependent variable and the predicted value \((y_i)\) based on the regression model. Correlation analysis is used to quantify the degree of linearity between two variables. The correlation coefficient \((R)\) ranges from -1 to +1 two variables are perfectly linearly related, plotting one against the other will produce a straight line and \( R \) will be either -1 or +1, depending on the direction of relationship. If the variables bear no linear relationship to each other, the value of \( R \) will be zero. A value of 1 tells that the dependent variable can be perfectly predicted from the independent variables. A value close to 0 tells that the independent variables are not linearly related to the dependent variable.

**Results and Discussions**

Additive Multiple Regression Analysis model has been developed for evaluating the residential property tax valuation for the study area and tested with descriptive statistics tools and correlations matrix. The statistical results show that some variables are excluded from the regression analysis; especially those are not good predictors. It is observed that the variables such as number of rooms, number of bathrooms, and total floor area appear as most significant variables. To make sure independent variable are linearly related to dependent variable, logs or square roots of one or both pair have been taken and scatter matrix before transmission and after transmission has been prepared. From the data sampling for self declared data, filed data and combine data, The value of coefficient of correlation \((R)\), Coefficient of determination \((R^2)\), Explanatory power \((\text{Adjusted } R^2)\) and Standard error of the estimate \((\text{SEE})\) has been obtained and shown in Table 2. In general, the explanatory power of AMRA model is high, indicating that key factors in explaining the property value. From the results, it is observed that the integrated model shows the improvement from self declaration with field data in terms of the explanatory power, standard error, accuracy and variability. The AMR Model has been examined with the regression residuals. In the standardized residual, the residuals are normally distributed so as to reduce its standard of errors to produce accurate values. The scatter plot of observed and predicted value of combined neighborhoods has been prepared and shown in Figure 5. It is observed from the scatter plots of observed and predicted values that value of \( R^2 \) is ranging from 0.8 to 1.0 shows a good linear relationship for all the cases and the predicted values falls within the confidence interval. Hence, the evaluation and validation of model proves it accuracy and better prediction power.
Table 2. Statistical parameters of self declared data, field data and combined data

<table>
<thead>
<tr>
<th>Area</th>
<th>Self Declared</th>
<th>Field Data</th>
<th>Combined Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>R²</td>
<td>Adjusted R²</td>
</tr>
<tr>
<td>Nallakunta</td>
<td>0.873</td>
<td>0.762</td>
<td>0.739</td>
</tr>
<tr>
<td>New Nallakunta</td>
<td>0.971</td>
<td>0.943</td>
<td>0.940</td>
</tr>
<tr>
<td>Tilak nagar</td>
<td>0.873</td>
<td>0.762</td>
<td>0.739</td>
</tr>
<tr>
<td>Total</td>
<td>0.937</td>
<td>0.879</td>
<td>0.877</td>
</tr>
</tbody>
</table>

Conclusion

The main purpose of this study is to develop the regression analysis model for evaluating the residential property tax valuation for the study area. The thematic maps of the study area have been prepared such as land use or land cover, road network and total floor area for assessing the property tax System of Central Zone, GHMC, Hyderabad. This study demonstrated techniques to enable for development of property valuation model using statistics and GIS. A sample is drawn of study area from where field data were collected. A valuation model is developed and it is tested with different statistical tools. The thematic maps has been prepared and categorized according to zoning for the study area. Descriptive variables have been selected for property valuation system and descriptive statistics has been obtained by using correlation matrix for the study area. The results show the annual
rental value is highly dependent on total floor area. In the set of variables total floor area, number of room & date of valuation are the dominating factors for determining value. Additive Multiplicative Regression Model has been developed for the study area. The AMR Model is evaluated and validated with different statistical analysis, and results shows great reliability. The value of coefficient of correlation (R), Coefficient of determination (R²), Explanatory power (Adjusted R²) and Standard error of the estimate (SEE) has been obtained. Taking natural logs have improved the R² value significantly. In the histogram of standardized residual of model, the residuals are normally distributed so as to reduce its standard of errors to produce accurate values. In the histogram of unstandardized residual of the model, the error term is normally distributed with a mean of zero and constant variance. Further, it is observed from the scatter plots of observed and predicted values that value of R² is ranging from 0.8 to 1.0 shows a good linear relationship for all the cases and the predicted falls within the confidence interval.

References