EXECUTIVE SUMMARY

1. HOUSING AND HOUSEHOLD ANALYSIS : POST-INDEPENDENCE ERA : 1951-1991

a) India's population of 846.3 million in 1991 is distributed over 153.4 million households and is sheltered in 148.4 million residential housing units (Tables 1.1 & 1.2).
b) The average household size is likely to decline faster in urban areas, than in the rural areas.
c) The reduction in household size and increase in income levels have resulted in a spurt in the housing demand, both quantitatively and qualitatively.
d) The disparity in the size of urban and rural households is likely to disappear by 2011.
e) The age, sex distribution of population, average age of marriage and growth rate of population relating to crude birth and death rates seem to be major factors which have wider influence in the formation of Households.
f) The growth rate in the housing sector is much higher than the growth rate of Households and the growth rate of Households is much higher than the growth rate of population in urban and rural areas (Table 1.3).

1.1 The number of persons per housing unit declined from 6.06 in 1951 to 5.52 in 1991 in urban areas whereas in rural areas it increased from 5.52 in 1951 to 5.77 in 1991. However, in the past decade the number of persons per house decreased from 6.03 in 1981 to 5.77 in 1991. The disparity in the occupation of persons per house between the rural and urban areas is disappearing and may reach 4.80 persons per house by 2011, in both urban and rural areas (Table 1.4 - Charts ES-1 & ES-2).

Chart ES-1 : Trends in Decadal Growth Rates of Population, Households and Housing Stock in Urban Sector

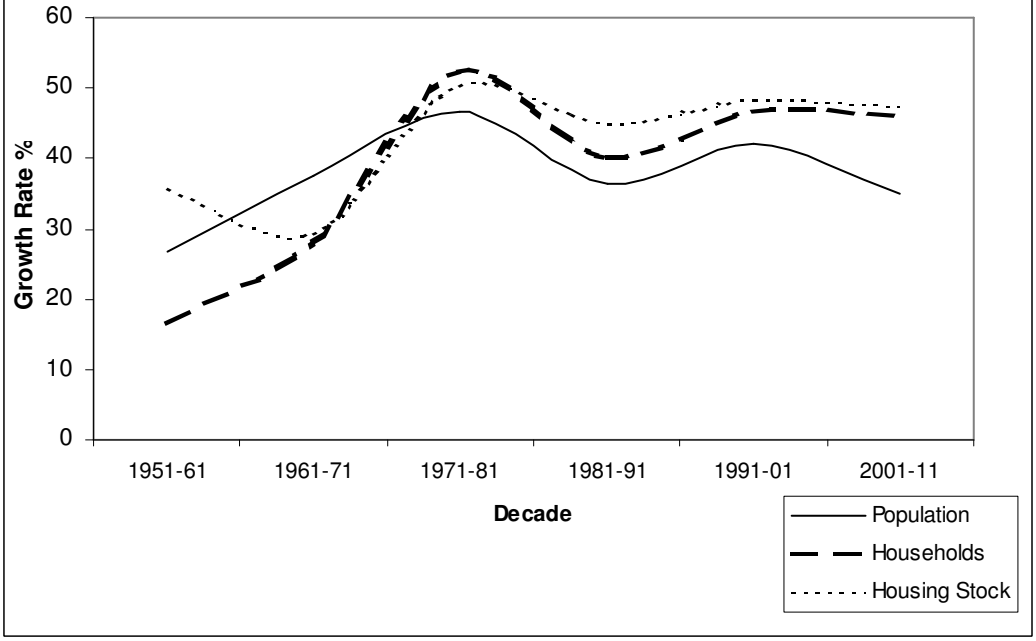
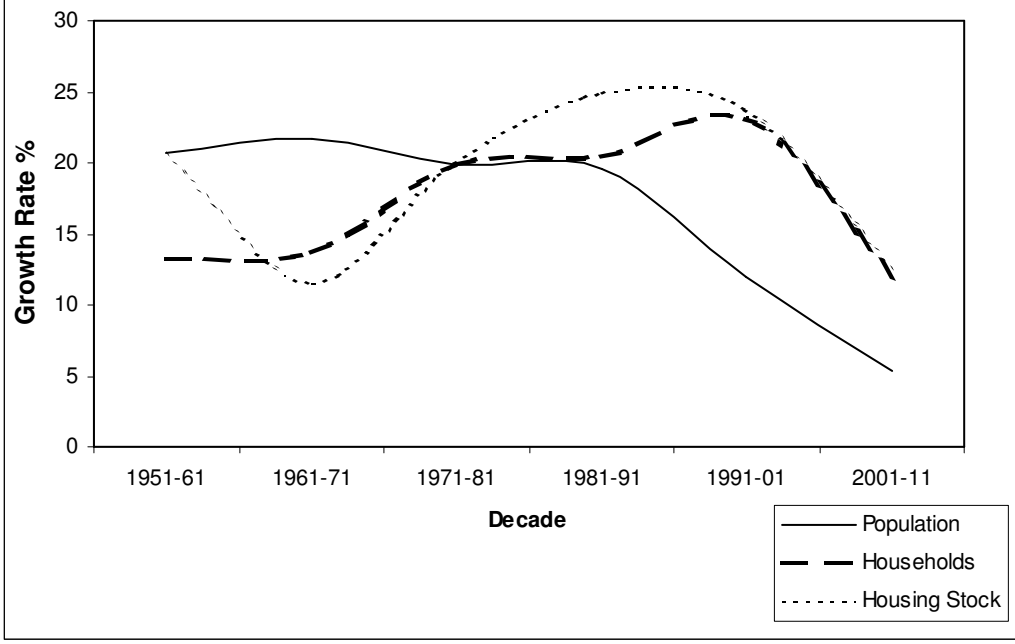


Chart ES-2 : Trends in Decadal Growth Rate of Population, Households and Housing Stock in Rural Sector



1.2 a) The percentage of pucca houses in the housing stock increased between 1951 and 1991. The number of kutcha houses declined considerably in urban and rural areas.

b) Pucca houses have more floor area than the kutcha houses (Table 1.8).

c) The ratio of residential and non-residential usage of housing units has more or less remained the same in urban sector during the period 1961 - 1991 (74.5% residential houses). The percentage of non-residential usage of houses declined in the rural areas from 27.4% in 1961 to 24.5% in 1991 (Table 1.5).

1.3 a) The income level of household has a direct relationship with the number of floors, besides location of the building, in both urban and rural areas.

b) The Tamil Nadu Housing and Building Studies (TNHB) have indicated that the urban residential building has an average of 1.96 houses, compared to the rural structure with an average of 1.18 houses.

c) The average floor area of a house is 615 sq. ft in urban areas and 433 sq. ft in rural areas.

d) The unit cost of construction of an urban house is Rs.68,251, which is 2.9 times higher than the unit cost of construction of a rural house at Rs.23,457 (Tables 1.7 and 1.8).

e) The size of household shows an increase from decade to decade. The percentage of households occupying one room tenements in urban areas declined from 53% in 1961 to 39.5% in 1991 whereas Households occupying two rooms or more, show a continuous increase in both urban and rural areas between 1961 and 1991 (Table 1.9).

1.4 a) There has been considerable improvement in amenities – drinking water, toilet and electricity enjoyed by Households during the past decades (Table 1.10).

b) Nearly 80% of the urban households have access to safe drinking water, while only 55% rural households have such a facility. Two-thirds of households have tap water in urban areas, while over 72% of rural households depend on wells, hand pumps/tube wells. Nearly 64% of the urban households and 9% of the rural households have exclusive toilet facilities. About 76% of the urban Households and 31% of the rural Households reside in dwellings with electricity facility.

1.5 Nearly 63% of the urban households lived in own houses in 1991, while it was 46% in 1961. Only 5.5% rural households lived in rented houses in 1991 (Table 1.11).

1.6 a) In urban areas the percentage of households residing in houses constructed with pucca roofing material, such as concrete, stone slabs, asbestos & GI roofing sheets, increased from 45% in 1961 to 62% in 1991, while the increase in rural areas is from 18% to 22% (Table 1.12A).

b) The houses constructed with kutcha materials like thatch, bamboo, grass, etc. are on the decline.

c) The higher income groups prefer RCC whereas lower income groups prefer tiles in place of grass, bamboo, etc. (Table 1.12B). Cement concrete is the choice for floor upgradation by a majority of the households.

1.7 a) Personal savings and borrowings are the main source of housing finance.

b) Only 8.9% of the urban households cited private money lenders as a source.

c) Housing finance through banks and institutions is mostly utilised by higher income groups.

d) Nearly 98% of the households are not aware of Housing Finance Institutions (HFIs), their terms and conditions for granting loans.

e) Less than 13% of the households are aware of new building materials & technologies. The awareness is high among the HIG rural households.

1.8 a) The TNHB studies indicate that the estimated cost of a house is three times the annual income of urban households and two times the annual income of rural Households.

b) The estimated average unit cost was Rs.68,251 and Rs.23,457 for urban and rural houses, respectively, in 1991 (Table 1.16).

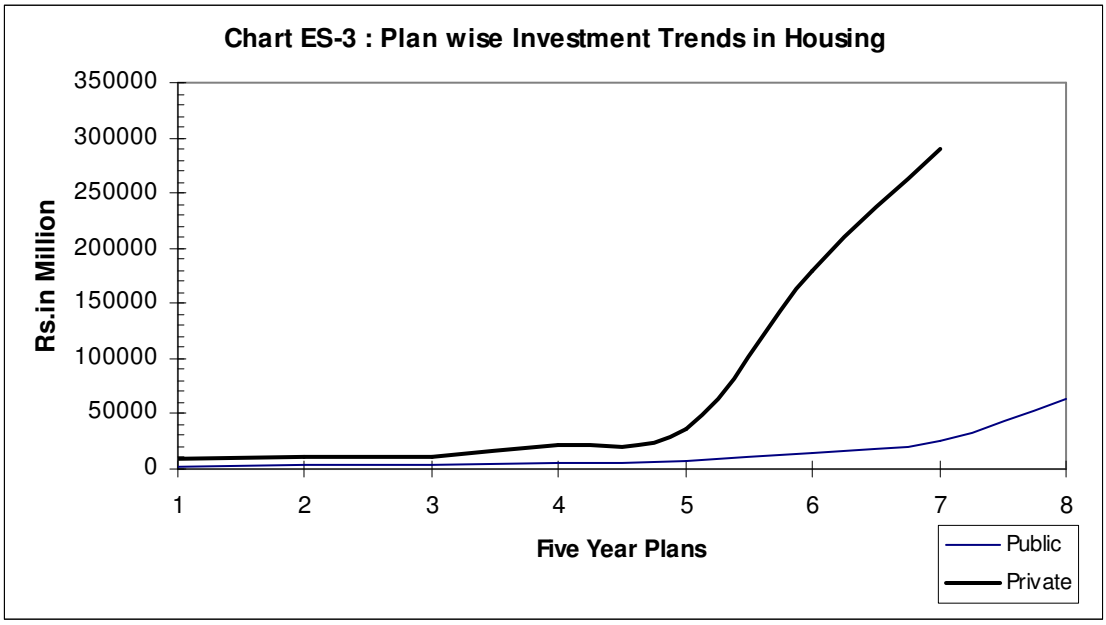
c) The desire to repay a loan for a new house is around 25% of household income in both urban and rural areas.

1.9 a) Investment in housing by private sector increased from Rs.9000 million to Rs.2,90,000 million from first five year plan to the seventh five year plan.

b) The ratio of investment by public and private sectors changed from 1:3.6 in the first five year plan to 1:12 in the seventh five year plan indicating greater involvement of private sector in housing activity (Table 1.17 & Chart ES-3).

c) The percentage of investment in housing to the total investment in the economy declined from 1st Plan (34%) to 7th Plan (9%).

d) There is a sudden jump in private investment in the housing during the 6th & 7th Plans. This trend is likely to continue in the future and the role of HFIs is likely to increase in meeting the demand of housing finance by both public and private sectors (Chart ES – 3).



2. HOUSEHOLD AND HOUSING FORECAST FOR URBAN & RURAL SECTORS : 1996-2011

2.1 a) A sophisticated model for forecasting housing supply, demand, deficit and upgradation needs upto 2011 has been developed by STEM (Chart 2.1 and Annexure 2.1), providing a bench-mark for future planning.

b) The forecast of housing is carried out under three scenarios (para 2.3), based on different assumptions :

i) Based on the model developed for the study.

ii) Based on Planning Commission's Methodology used for IX Five Year Plan.

iii) Based on past trends and Planning Commission Methodology.

c) The estimates of the STEM model are sensitive to the changing demographic and economic characteristics of population.

d) The model estimates in 2011 (Scenario A) on housing supply, deficit, and upgradation needs are lower than the estimates made by other two methods (Scenarios B & C). However, the number of Households that are likely to form by 2011 are higher in the estimates made by the model under Scenario A.

The model has a unique approach for forecasting households and housing :

i) Projections for urban and rural sectors are made separately.

ii) Formation of Households has been considered based on factors of age, sex and marital status.

iii) Projections are related to expenditure in national income.

2.2 a) The size of the household i.e., persons per household, has declined during the past two decades and this trend is likely to continue, in future.

b) The model predicts that the size of the household may reach 4.78, in both urban and rural areas by 2011 indicating disappearance of the disparity between the two sectors by then.

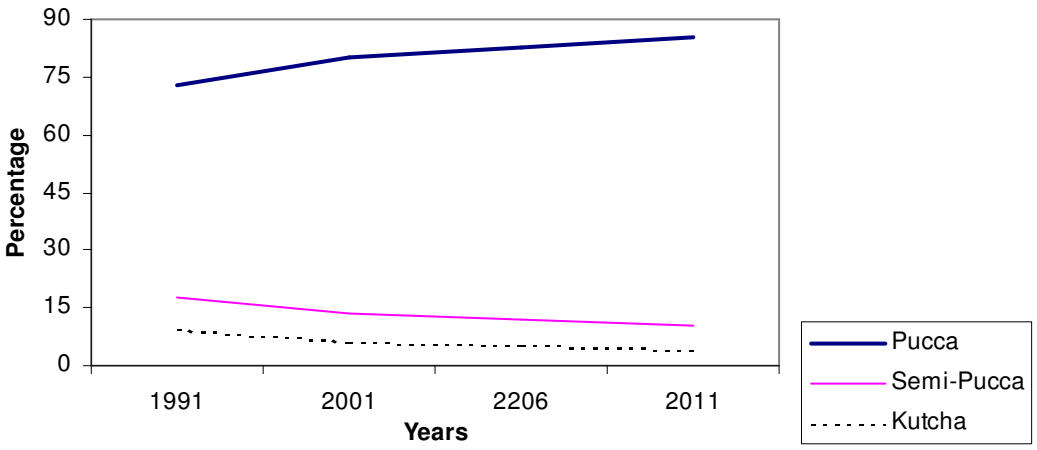
c) The number of Households in the next two decades will be higher in urban sector compared to rural sector.

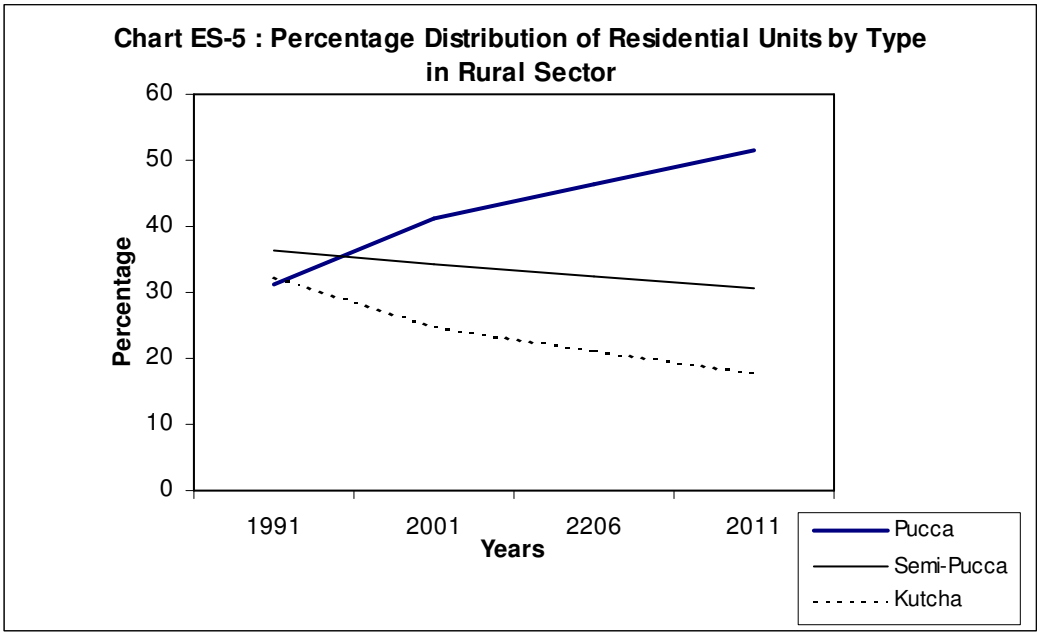
d) The no. of Households in urban sector is likely to be doubled between 1991 and 2011 and reach 87.3 million by 2011. The no. of rural households is likely to reach 155.2 million by 2011, which will be 1.4 times of the households in 1991 (Table 2.1 and 2.2).

e) The residential houses in urban areas are likely to increase 2.2 times, (86.17 million), whereas the rural households will increase by 1.4 times (151.79 million) during 1991 to 2011 (Chart ES-4 & ES-5).

f) The index of residential house/household shows marked improvement for 1991-2011, from 967 and 968 to 988 and 978 for urban and rural sectors respectively. It may marginally exceed one house per one household if housing units in bad service conditions are included in computing available housing stock for use (Table 1.2).

Chart ES-4 : Percentage Distribution of Residential Units by Type in Urban Sector





2.3 a) Quality of housing in both urban and rural areas is likely to improve in the coming two decades.

b) Kutcha houses in both the sectors, show a declining trend from 1991-2011 (Table 2.4).

c) The growth rate of semi-pucca houses will be 0.52% and 12.22% in rural and urban areas respectively during 2001-2011 (Table 2.3).

d) All the three scenarios forecast that there will be fast growth in pucca houses, declining growth in kutcha houses and a marginal increase in semi-pucca houses (Table 2.4). The percentage of pucca houses is estimated to go up from 1991 to 2011 thus : from 73 to 85 (urban) and 31 to 52 (rural) (Table 2.5).

2.4 a) During 1991-2011, housing units in bad condition are likely to go up from 4.93 million to 7.42 million in urban sector, while they will decline from 21.30 million to 20.83 million in rural sector. This is mainly due to decline in construction of kutcha houses in rural areas (Table 2.6A).

b) Scenarios B & C present the total housing in bad condition by 2011 as 35 million and 34 million, respectively (Tables 2.6B & 2.6C).

2.5 a) The total urban housing stock both residential and non-residential together will be 115 million under scenario A and around 118 million under scenarios B & C by 2011 (Table 2.7).

b) The projection for rural areas by 2011 will be 202 million, 239 million and 255 million under scenarios A, B & C respectively (Table 2.7). The higher discrepancy in the projections of rural housing under scenarios B & C is mainly attributed to assumption that the current trend of rural housing will continue in future.

2.6 a) The housing deficit computed so far includes the unserviceable housing stock along with the housing shortage calculated, based on housing stock available

in relation to the households. Since this methodology is likely to give an exaggerated figure of housing deficit, a radical change is called for in the computation of these figures.

b) The housing and household ratio has almost reached 1:1 which means that most of the households have a shelter or roof over the head.

c) It is therefore necessary to make a pragmatic approach in estimation of the effective residential housing deficit and the residential housing stock needing upgradation.

d) The effective residential housing deficit (-)/surplus(+) under scenario A in urban areas, is –1.28 million in 2001, –1.19 million 2006 and –1.08 million in 2011. Whereas Scenarios B and C show surplus of +1.35 million and +0.97 million respectively in 2011.

e) In rural areas the scenario A exhibits deficit of –3.81 million in 2001 and –3.44 million in 2011 while scenarios B & C, exhibit huge surplus +24.12 million and +35.85 million houses respectively in 2011.

For c, d & e vide Table 2.11

3. EXPENDITURE ON RESIDENTIAL BUILDINGS AND CONSTRUCTION SECTOR – A REVIEW & PROJECTION OF PAST AND FUTURE TRENDS

3.1 a) The Gross Domestic Product (GDP) can be used as an important determinant in computing Gross Domestic Capital Formation (GDCF) at the macro economic level. Through GDCF, the capital formation, in various sectors including construction can be computed.

b) The share of construction sector in GDCF, which hovered around 60% during 1951-61 declined to 41% in 1994-95.

c) The residential buildings account for 10% of GDCF in 1994-95 whereas the non-residential buildings and other forms of construction account for 10.5% and 19.8% of GDCF, respectively (Table 3.1).

d) The time series data on GDP, GDCF vis-à-vis the construction sector for 1965-95 the annual growth rates are computed (Table 3.2, 3.3 & 3.4); which will throw light on certain crucial facts.

3.2 a) Expenditure in the construction sector increases more than two times every five years.

b) In the construction sector, the share of residential buildings increased from 23% in 1980-81 to 26% in 1994-95.

c) While share of the non-residential buildings increased from 21% to 26%, the share of other forms of construction declined from 56% to 49% during the same period. (Table 3.3).

3.3 Forecasting Model

a) Forecasting of expenditure in the construction sector and sub-sectors is carried out under two different methods.

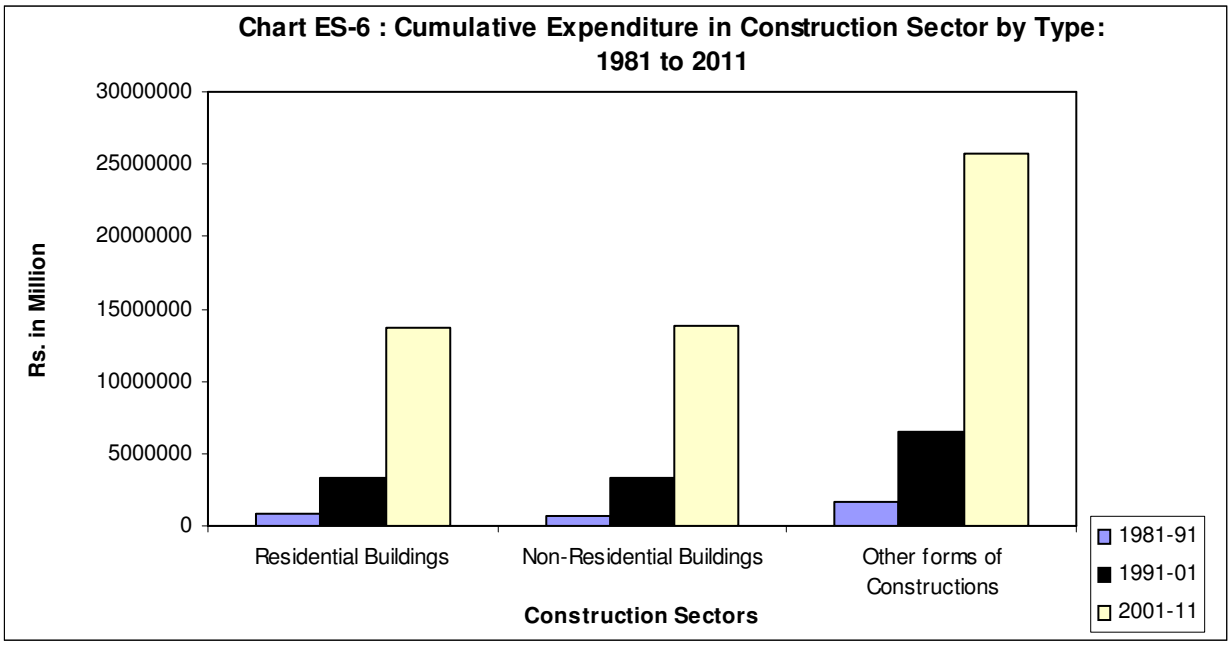
i) The first method is based on ARIMA model where estimates of GDP are prepared and used in construction and its sub-sectors.

ii) The second method is based on evolving the linear regression equations between (1) GDP & GDCF, (2) GDCF & construction sector and (3) construction sector with residential, non-residential and other forms of construction (Annexure 3.1).

b) According to projections based on the second method, the expenditure on total construction activities will go up from Rs. 970,250 million in 1994-95 to Rs.9,223,758 million by 2010-2011 (Table 3.3).

c) The projections obtained from second method are used in the study for further calculations of requirement of key building materials, labour force and computing average housing unit cost.

3.4 a) The cumulative expenditure of residential housing in urban and rural areas and non-residential building including Industrial, R.C.C. and load bearing types and other form put together goes up to Rs.53,242,261 million in 2001-2011 from Rs.3,142,320 million in 1981-91 (Tables 3.5 and 3.6.)



b) Based on cumulative expenditure on all residential buildings completed from 1981 to 2011, cost of housing unit is estimated decade wise.

c) The average unit cost of an urban house is estimated to increase from Rs.1.16 lakhs during 1991-2001 to Rs.3.29 lakhs during 2001-2011. During the same period, the average rural house unit cost will increase considerably from Rs.0.42 lakhs to Rs.2.7 lakhs.

d) Higher increase in the cost of a rural house can be attributed to the improved quality of construction, choice of materials and improved infrastructure within the house, with the likelihood of more semi-pucca and pucca houses coming up.

e) The expenditure on urban residential houses comprises materials (75%), labour (22%) and services (3%), whereas the comparative figures for rural sector are 78%, 20% and 2% respectively (Table 3.8).

f) There is a likely to be a four-fold increase both in cost of materials and labour force in urban areas during 2001-2011.

3.5 a) Forecast of key building materials such as, cement, steel, timber, bricks and plastics for total construction sector during 1996-2011 is made based on projected expenditures for both material and labour.

b) A model for estimating the requirement of key building materials was worked out based on data available with STEM & CSO for residential buildings; NBO, CSO & BMTPC for non-residential buildings and other forms of construction (Annexure 4.1).

c) The proportion of consumption of key building materials (weightage) for different types of construction has been computed (Table 4.3) and an inflation rate of 5% per year for the price of building material is taken to work out the price of building materials for any particular year. The total requirement of key building materials cement, steel, timber, bricks for total construction sector and sub-sectors is worked out on cumulative basis for the periods 1996-2001, 2001-06 and 2006-11 has been estimated (Tables 4.4, 4.5 & 4.6).

4. FORECAST OF KEY BUILDING MATERIALS : CEMENT, STEEL, TIMBER, BRICKS AND PLASTICS FOR TOTAL CONSTRUCTION SECTOR : 1991-2011

4.1 a) The projected cumulative requirement of cement for urban and rural housing activity will be 78.8 and 31.08 million tonnes respectively for the period 1996-2001, whereas the demand for total construction sector will be 415.37 million tonnes.

b) The projected finished steel requirement for the same period is 8.65 million tonnes in urban housing. 3.31 million tonnes in rural housing while the requirement of the entire construction sector will be 63.63 million tonnes.

c) The requirement of timber for urban housing and rural housing is 5.33 million cu.m. and 3.72 million cu m. respectively for 1996-01, while the total demand for the construction sector will be 36.24 million cu m.

d) In case of bricks 201.85 billion and 178.58 billion numbers are required for urban and rural housing respectively during 1996-01 while total requirement for construction is 857.30 billion (Table 4.4 for a, b, c & d).

e) The projected demand of key building material for total construction sector for period 2001-06 is 656.02 million tonnes of cement and 100.57 million tonnes of steel, 56.98 million cu.m. of timber and 1350.57 billion numbers of bricks (Table 4.5 – Charts ES-7, ES-8, ES-9 & ES-10.)

f) For the period 2006-11 the requirement of cement and finished steel will go up to 1034.97 million tonnes and 158.72 million tonnes respectively (Table 4.6).

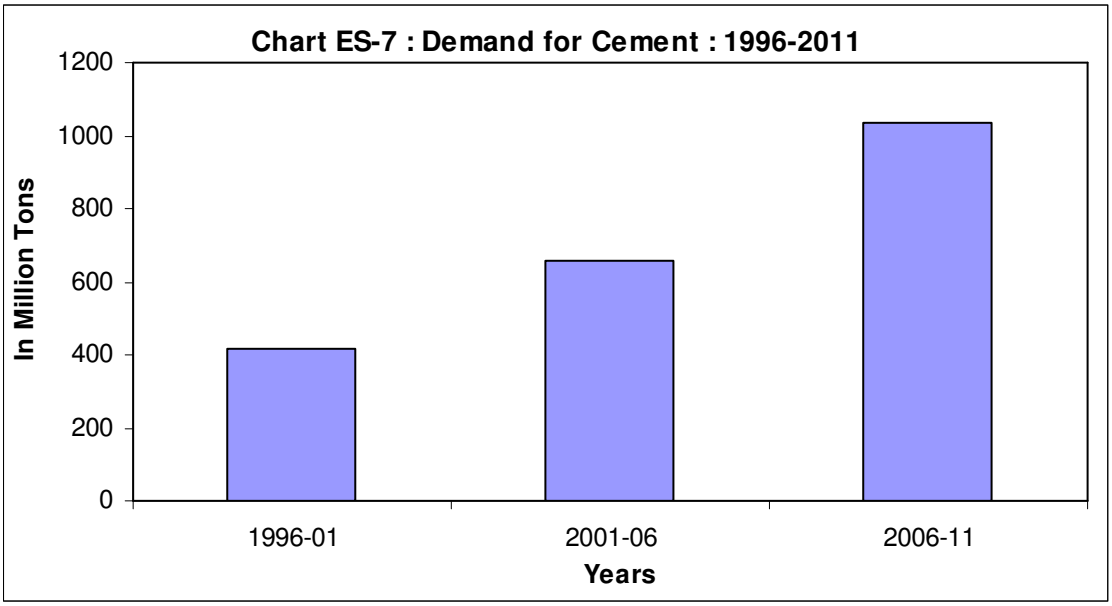


Chart ES-7 : Demand for Cement : 1996-2011
In Million Tons
1200
1000
800
600
400
200
0
1996-01
2001-06
2006-11
Years

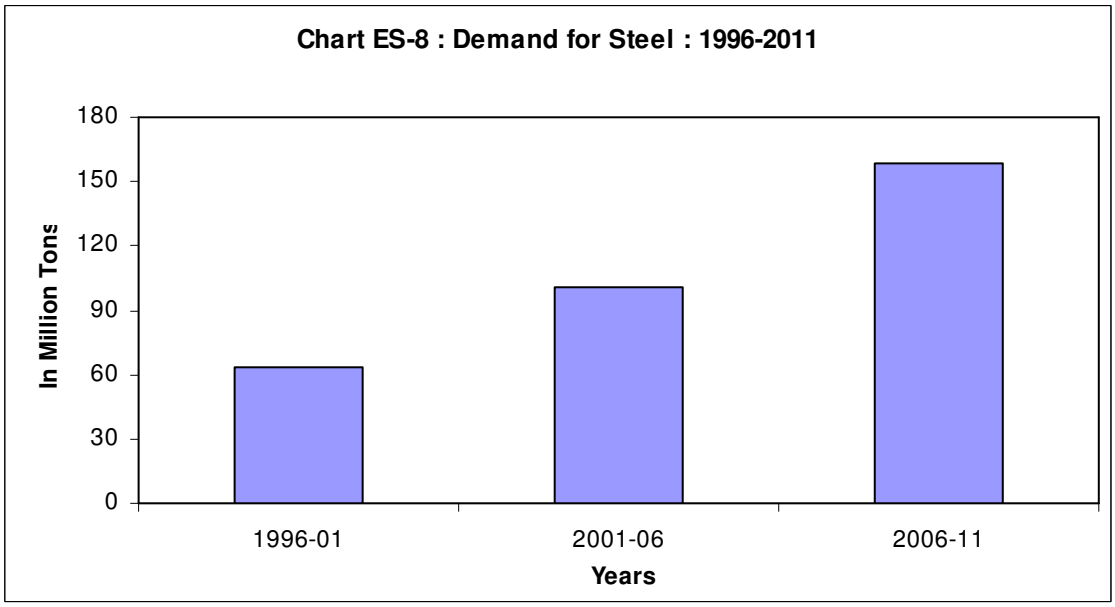


Chart ES-8 : Demand for Steel : 1996-2011
In Million Tons
180
150
120
90
60
30
0
1996-01
2001-06
2006-11
Years

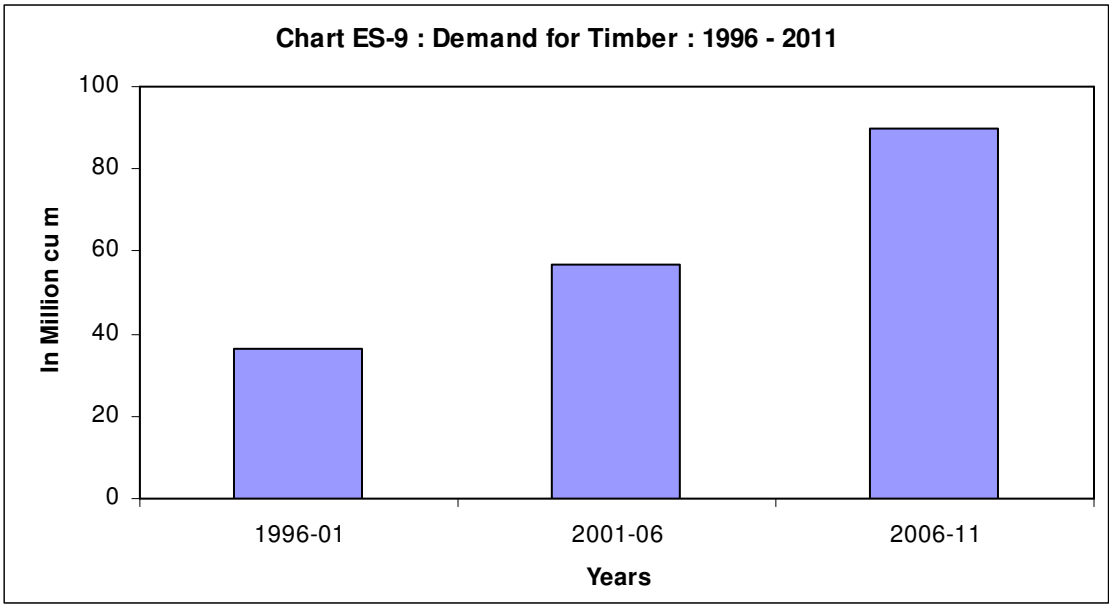


Chart ES-9 : Demand for Timber : 1996 - 2011
In Million cu m
100
80
60
40
20
0
1996-01
2001-06
2006-11
Years

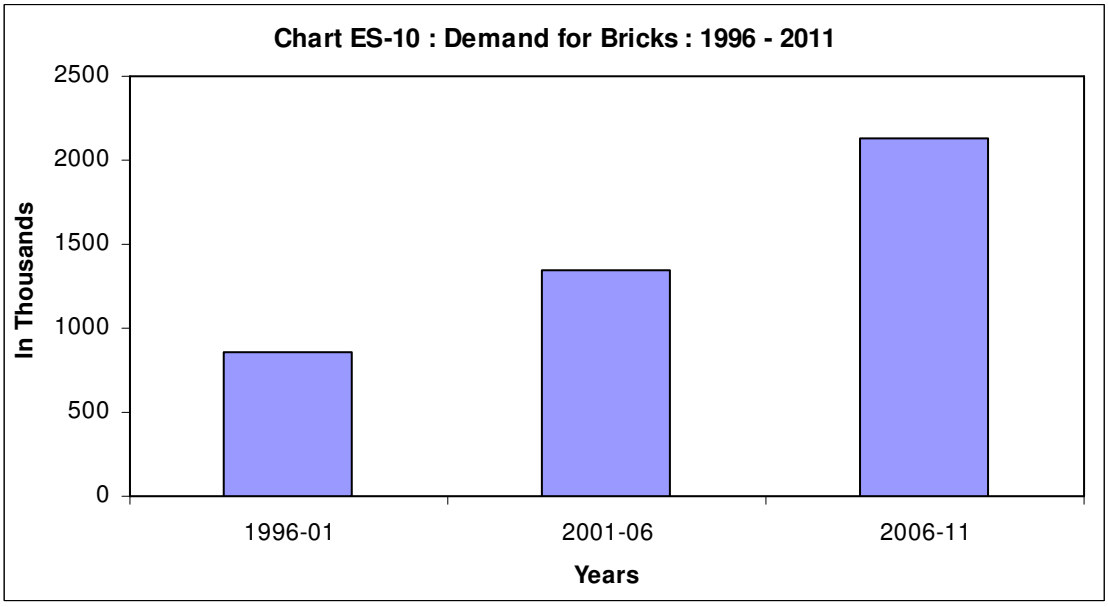


Chart ES-10 : Demand for Bricks : 1996 - 2011
In Thousands
2500
2000
1500
1000
500
0
1996-01
2001-06
2006-11
Years

4.2 a) Apart from steel and cement, authentic and reliable information about production of other key building materials like brick and timber in the past became difficult to obtain as they are produced in unorganised sector.

b) The average annual growth rate of cement and finished steel production for 1991-96 is 7.5 per cent and 10 per cent respectively.

c) Out of the total production of finished steel 45 per cent is used in construction industry.

d) Assuming similar growth rate, the projected annual production of cement and finished steel for years 1991-96 to 2010-11 has been estimated (Table 4.8a) and their cumulative projected availability for construction sector for period 1996-01, 2001-06, 2006-11, is given in Table 4.8b and 4.8c respectively.

e) During 1996-2001, surplus of +19.03 million tonnes (+4.58%) of cement and +1.04 million tonnes (1.6%) of finished steel is projected for construction sector.

f) Cement for construction sector will shortfall the demand by –32.39 million tonnes (-4.94%) and –139.67 million tonnes (-13.5%) for the periods 2001-06 and 2006-11 respectively.

g) For the same periods, the position of finished steel is better, the availability of finished steel for construction surpasses the demand by +3.61 million tonnes (+3.58%) during 2001-06 and by +9.02 million tonnes (+5.68%) during 2006-2011 (Table 4.9 for e, f & g).

h) Ways and means have to be adopted to meet the projected shortage of cement such as use of standard quality hydrated lime for some building applications, increased production of blended cements – masonry cement, flyash / clay pozzolana cement and adoption of new cost-effective techniques for construction et al.

i) Information available indicate that there will be considerable shortfall of bricks and timber for construction sector as negative growth of brick and timber production is expected in the periods 1996-01, 2001-06 and 2006-11 (Part – IV : paras 4.7 and 4.9).

j) Substitutes for burnt-clay bricks such as sand-lime bricks, hollow concrete blocks, soil stabilized bricks and mechanisation of burnt clay production will enable to meet the shortfall of bricks.

k) Increased used of wood substitutes such as iron / aluminum / plastic door and window frames, wood composites will help in reducing the gap between supply and demand.

4.3 a) Over 20 per cent of plastic production (1.8 million tonnes) in India is consumed for various building applications.

b) One of the major contributions of plastics has been to upgrade the performance of traditional materials like wood, cement concrete, steel and enhance their life through the use of surface coating and adhesives.

c) The use of PVC, PC and GRP pipes for water supply schemes and drainage, cable ducts, PE water storage tanks, building hardware made of plastics have successfully replaced G.I./C.I./AC/RCC pipes, RCC and MS water tanks.

d) As an alternative to timber, PVC extruded profiles for paneling and partitions, door and window frames, shutters have been successfully used.

e) In respect of outdoor performance of plastic products / components the need for careful formulations using desired additives and colour is of importance.

f) Fire preventive measures are required in case of use of plastic products in buildings.

4.4 a) Labour constitute 21.78% of cost of construction of residential buildings in urban areas and 20.16% in rural areas (Table 4.2).

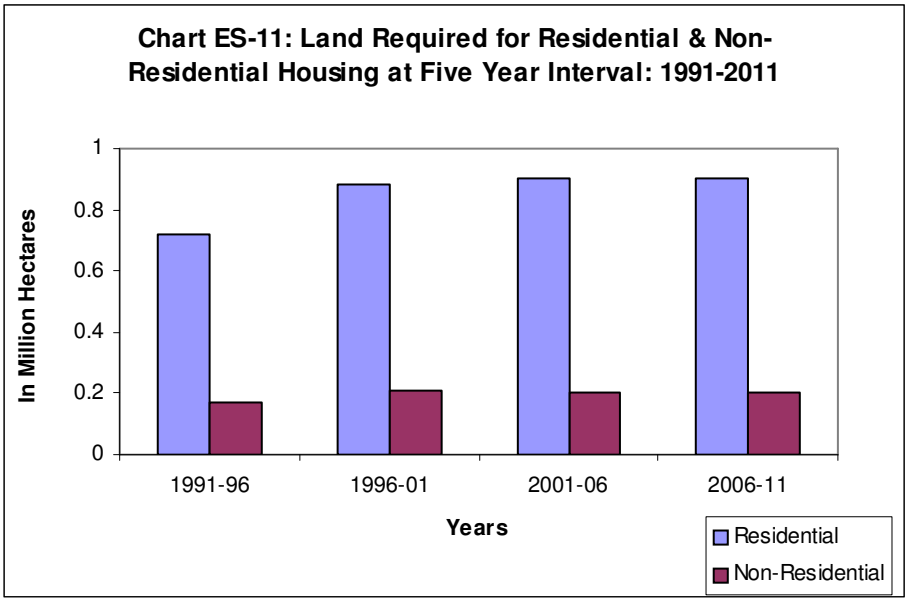
b) During the period 1996-2001, the residential building sector will provide employment of labour 15.06 million man years. 10.32 million man years in urban areas and 4.74 million man years in rural areas.

c) During this period in the urban areas, 3.61 million man years of masons, 0.78 million man years of carpenters, 4.71 million man years of unskilled labour and 1.22 million man years of other type of labour will find employment in residential building sector.

d) The total cumulative requirement of labour for 2001-06 and 2006-11 is 23.78 million man years and 37.53 million man years respectively (Table 4.12).

4.5 a) The residential sector and non-residential sector will require 3.4 and 0.78 million hectares of land between 1991-2011 (Table 4.13 – Chart ES-11.)

b) In urban areas the residential sector will require 1.3 million hectares of land.



5. EMERGING TRENDS IN BUILDING MATERIALS, TECHNOLOGIES AND CONSTRUCTION METHODS

a) The conventional materials – brick, cement, aggregate, lime, timber, etc. will fall considerably short of their demand despite improved productivity.

b) Lime and lime-based/products manufactured through advanced technologies are re-emerging as a beneficial and competitive binder to cement in the form of hydrated lime, rapid setting lime plaster, activated lime pozzolana mixture etc.

c) Brick made of flyash, red mud, calcium-silicate bricks, soil stabilized bricks, hollow concrete blocks and structural clay blocks which are being used in the construction will gain popularity.

d) Glass fiber reinforced gypsum, plastic composites / steel / aluminium, etc. are a good substitute for timber in door and window frames, partition walls, etc.

5.1 a) The concept of designed masonry construction is expected to initiate high rise construction in masonry, which will focus on high strength concrete and ready mixed concrete.

b) The drive to economise on space has led to adoption of framed structure avoiding all load bearing walls.

c) New materials like light weight aggregate from foamed slag, cellular concrete provide higher ratio of strength to weight will have good demand.

5.2 a) R&D Institutions in India have developed number of technologies for production of new building materials which are cost effective and eco-friendly with special attention to utilisation of industrial and agricultural wastes (Annexure 5.1.1 to 5.1.6).

b) Most of them are still in experimental or demonstration stage. Flyash, waste paper, coir waste and rice husk have been tried more frequently for use as building material at specific locations and the commercial viability has yet to be established.

c) The social benefits, costs and environmental analysis only could make the building materials prepared from wastes viable and adaptable in specific locations.

5.3 a) Substructure and super structure cost of a high rise building can be as high as 1½ times to 2½ times of the cost of simple traditional building of single or double storeyed houses of equivalent occupied floor areas.

b) The conventional two or three story building will continue to remain popular and will be constructed in very large numbers in many cities and towns where suitable, large well-developed land areas are located.

c) Land development costs are high even in remote sub-urban regions of big cities. If the development costs to be shared by the end-users, the overall long-term cost of a unit (apartment / flat) of a multi tenant high rise building may be much less than the cost of a isolated building built and owned by a single owner.

d) There are many more social, economical and long-term financial advantages in apartment systems, shared offices, shops, service-oriented centres, etc.

e) Multi-storey buildings and clustered housing have become common in Indian cities and this trend will continue spreading in larger areas in smaller cities and large towns.

f) Many modern developments such as precast construction when used only on a large scale and mass production will be economical.

5.4 a) Efficient scaffolding systems and vibrators for compaction of concrete is essential for multi-storey building construction.

b) Tower cranes and hauling equipment become necessary at all stages of construction.

c) Although construction equipment is presently available in India, their requirement will increase considerably and plans have to be drawn to meet this growing demand.

5.5 Further Trends in Major Elements of Building

a) In low rise buildings and tall buildings the use of light weight blocks – hallow concrete, cellular concrete, foamed concrete will be in increase to reduce dead loads of internal and non-load bearing walls. Whenever functional requirements are not restrictive, inter walls will be replaced by partitions, boards or panels of light weight concrete, ferrocement, FRP gypsum, plastics or reconstituted wood.

b) Trend to build tall buildings and clustered buildings will be in increase. In such operations it is beneficial to use pozzolanas, whenever design permits. On site concrete block making machines will be popular.

c) Deeper, wider column footings, strip or raft foundations, will be more common even for low rise buildings. For high rise buildings, pile foundations will be most common even in good site conditions. The industry for production of precast piles will get a boost. Pile driving equipment will be needed in larger numbers than at present.

d) The number of doors and windows that can be provided in room units will be much less than an equivalent traditional room. Because of space restriction, the shutters would be preferably of sliding type. Windows will be low weight as metal windows with glazing and anodised aluminium framing will be common. Almirahs and storing or stacking space would be provided for and built into walls or partitions.

e) Lifts form the single, most complex and costliest system in tall buildings. Industries manufacturing lifts and associated equipment need expansion and quality and service reliability have to improve. Since staircases have to be provided in sufficient numbers in additions to lifts to satisfy emergency vacation of tall buildings, all materials and products used for stair cases would be required in large quantities.

5.6 Security and Fire safety equipment will be required in large numbers for high rise buildings in the future as their installation becomes imperative.

5.7 Water supply, drainage, sanitation, wastage disposal, air vents, electrical, communication, etc. will have to well segregated for safety and health also,

according to code requirements. Usage of plastic pipes and fixtures of different grade and diameters, fixture and fittings would be required in much larger quantities than before.

5.8 In tall and clustered buildings, amenity areas like kitchen, bath room or toilet will be much smaller. Such amenities per person will be on increases, since income levels of urban population are increasing many more new luxurious items/products would come into market and find acceptance.

5.9 The products of the future have to be designed for high degree of integration and manufactured in large plants under strict quality control and coordination. Firms providing packaged service of installation, maintenance and servicing of such integrated units would be required in large numbers in well distributed locations.