CHAPTER 9
CONSTRUCTION

Coverage

9.1 The construction activity as per the International Standard Industrial Classification (ISIC) adopted in the SNA consists of contract construction by general builders, civil engineering contractors and special trade contractors. Also included is own account construction carried out by independent units of enterprises or other organisations which are not part of the construction industry proper. But, owing to the problems of availability of data separately for units carrying out construction work, construction industry, for the purpose of estimating domestic product, has been taken to include the whole of construction activity (contractual as well as own account) including construction work connected with planting and cultivating of new forests, plantations and orchards. Thus the scope of the industry is wider than that outlined in major division 5 of NIC, 1987. Due to lack of data, demolition activity has, however, been excluded.

Methodology and Source material

Estimates at Current Prices

9.2 The estimates of GVA are derived from the corresponding estimates of value of output, i.e., value of construction by types. The estimates of value of output from construction activity are prepared separately for pucca construction and labour intensive kutcha construction. In the case of former, the estimates are prepared by commodity flow approach and the value of all pucca construction undertaken with the use of construction materials such as cement, steel, bricks, timber, fixtures etc., is determined. The estimates of labour intensive kutcha construction undertaken with the help of freely available materials like leaves, reeds, mud, etc.,on the other hand, are prepared by expenditure approach using data from sample surveys, budget documents of central/state governments and local authorities and annual reports of public sector and private sector enterprises.

Value of output of pucca construction

9.3 The value of output of pucca construction are prepared by the commodity flow approach. The commodity flow approach envisages estimation of production of commodities used in construction and adjusting them for inputs in other industries, changes in stocks, imports and exports for obtaining estimates of net availability for construction purposes. The commodities available for construction are evaluated at prices paid by the builders at the site of construction. Information on retail prices, transport costs, dealers' margins and indirect taxes collected from various sources is used to estimate the value at site.

9.4 As the data on regular flow of all input materials going into construction are not available annually, the total value of construction as referred to above is estimated in three parts viz., (i) the value based on inputs of five basic construction materials, (ii) the value based on inputs of other construction materials and (iii) the value based on inputs of factor payments for construction activity. The value obtained on the basis of the five basic input construction materials viz., (i) cement and cement products, (ii) iron and steel, (iii) timber and round wood including veneer and plywood, (iv) bricks and tiles and (v) permanent fixtures and fittings is discussed in detail in the following paras.

Cement and Cement products

9.5 Cement is produced only in the organised sector and the data on total dispatches of cement to States/Union Territories for consumption are available by categories of 'rate contract', 'other than rate contract' and 'free sale' from the annual publication "Cement Production and Despatches "brought out by Cement Controller of India. This publication also gives information on prices of cement including free on rail and retail-sale price of cement in each State/Union Territory. From the data on total quantity of cement dispatched, the net quantity of cement available for construction is determined by excluding the estimated quantity of cement used for intermediate consumption in other industries and adjusting for net imports. The estimated quantity is then evaluated with the help of appropriate prices of different types of cement dispatches. The total value of cement used in construction as obtained above is marked up by 2 per cent to take account of the transportation costs from the point of purchase to the site of construction. The value of output of cement includes the value of cement products like asbestos sheets, jalis, hume pipes etc., as available from ASI and the corresponding quantum of excise duties and TTMs, etc., thereon. The data in respect of excise are taken from Directorate General Of Commercial Intelligence & Statistics (DGCIS) publication entitled "Statistics of the Customs and Excise Revenue Collections of the Indian Union". Various steps involved in the estimation of the value of cement used in construction are presented in Table 9.1.

Iron and steel

9.6 Iron and steel products which are taken into account as being used in construction, consist of items like heavy structurals, light structurals, heavy rails, fish plates, corrugated sheets, bars and rods, sleepers, railway track material and iron and steel structurals comprising bridge work, fabricated structurals for buildings or transmission towers, sluice gates fabricated out of rolled section, gates and grills, shutters including rolling shutters, etc. The value of these goods is taken from the ASI reports for the census and sample sectors An adjustment is made for non-response in the census sector of ASI on the basis of the total number of workers employed in responding and non-responding factories. From the total value of products, the value of such products used as inputs in other industries are excluded to estimate the value of products used for construction purposes. The ASI reports for the sample sector contain information for only industry groups upto three-digit level of NIC-1987, and itemwise break-up of the value of products is not available. Accordingly, the proportion of iron and steel used in construction to the total production reported in the census sector is worked out at the 3-digit level of NIC-1987 and applied to the total value of products given in the corresponding groups of iron and steel products (of the sample sector) used in construction. The detailed ASI data are, however, available for the recent years for 1973-74 for the census and sample sectors separately and for 1978-79 and 1983-84 for the entire factory sector. For the years for which only summary ASI data are available, the estimates have been prepared by applying the ratio of the value of iron and steel goods used in construction to the total value of products and by-products of the relevant industry groups obtained from the latest available ASI results. For the subsequent years for which ASI results are not yet available, the estimates have been carried forward with the help of changes in the production of finished steel and relevant index of wholesale prices for iron and steel products.

9.7 The estimates of iron and steel goods produced in the unregistered manufacturing sector, used as input in construction are based on the value of corresponding output of unregistered manufacturing units. The proportions of the value of output of iron and steel goods used in construction to the value of output for iron & steel as available from the latest detailed results of the sample sector of ASI for 1973-74 have been applied to the relevant value of output in the unregistered manufacturing sector. As the item-wise details of output of the sample sector have been tabulated only for 1973-74, the proportions obtained for 1973-74 have been used for the subsequent years also.

9.8 The aggregate value of domestic supply of iron and steel products available for construction thus estimated is exclusive of indirect taxes & duties and TTMs. To arrive at the value of construction at site, adjustment has been made on this account. The share of import duties attributable to imports of steel products used in construction is worked out on the basis of the proportion of iron and steel goods used in construction to the total iron and steel imported. Data on trade, transport and other charges have been worked out on the basis of information obtained from the Railway Board, sales tax data obtained from the State Governments and information collected by the CSO from a number of engineering companies dealing in iron and steel products. The adjustment factor is estimated to be 15 per cent of the total value. The detailed procedure of estimation of the value of iron and steel used in construction is given in Table 9.2.

Timber and roundwood

9.9 Direct data on the production of timber and roundwood are not separately available. Instead, information is available on production of industrial wood comprising mainly timber and roundwood as received from the respective State Governments. From this total quantity of timber produced, timber used as railway sleepers is deducted to obtain the quantity of timber available for other uses. The quantity of timber utilised for making railway sleepers is obtained from the Railway Board. Of the residual quantity of timber, 48.5 per cent is taken as having been used in construction. Roundwood used in construction is taken to be 38 per cent of the total quantity produced. These proportions have been worked out on the basis of information contained in the 'Timber Trends Study for the Far East, Country Report for India, 1958' (The IGF). The total quantity of timber used in construction has been evaluated using all-India average prices issued quarterly by the National Buildings Organisation (NBO) in 'Prices of Building Materials and Wage Rates for Building Labour' (mimeographed). The total value thus obtained is adjusted for TTMs to obtain the value at the site of construction. Information on TTMs for railway sleepers is obtained from the headquarters of the Northern Railway and for timber and roundwood used in construction (other than railways) from the TTS and directly from the dealers. One-third of the value of "Veneer, plywood and their products" as available from ASI has now been included in the value of timber and roundwood used in construction. This has been done on the basis of discussions held with the dealers engaged in the trading of veneers & plywood etc. The procedure of estimation of value of timber and roundwood used in construction is given in Table 9.3.

Bricks and tiles

9.10 Estimates of the quantity of bricks and tiles are prepared on the basis of information on dispatches of coal used for brick burning published in the Monthly Review of Coal Production and Distribution (Coal Controller) supplemented by information collected from the Office of the Coal Controller on dispatches of coal by road for brick burning. On the basis of the information collected from the Office of the Coal Controller, NBO, CPWD and various kiln owners, average quantity of coal needed for producing one lakh of bricks and tiles has been estimated. This proportion is used to determine the total quantity of bricks and tiles produced in the small scale sector. The output of bricks in the sector is evaluated at all-India average retail prices regularly collected and published by NBO along with the prices of timber etc. The discussions held with the brick kiln owners revealed that hardly any coal was being used in the manufacture of bricks & tiles in the registered manufacturing (ASI) and the coal dispatches were mainly used for burning bricks in the un-organised sector. As such the value of production available from ASI has been taken into account explicitly and treated as organised. Besides in small scale industries, a large number of rural households produce bricks for own use. In the absence of any other data their contribution has been taken to form 10 per cent of the value of production of bricks & tiles produced in the small scale sector on the basis of data on working force engaged in the manufacturing of structural clay products as per 1981 population census. The value obtained from ASI is marked up by 25 per cent for TTMs on the basis of information obtained from a large number of kiln owners and also sales

tax data from the state authorities. Steps involved in the preparation of the estimates of bricks and tiles used in construction are described in Table 9.4.

Fixtures and fittings

9.11 Data on value of production of a large number of fixtures and fittings of permanent nature, such as fans and blowers, insulators, electric cables and wires, water meters, house service meters, sanitary fittings, etc., used in construction are collected from the reports of the ASI and from DGTD. For the years for which ASI data are not available, DGTD data are used. TTMs are estimated to be 35 per cent which is added to the value of output to arrive at the value at site. Details of estimation are shown in Table 9.5.

Other construction materials

9.12 Further, in the case of other construction materials like lime, glass and glass products, paints and varnishes etc., sufficient annual data do not exist for independent estimation. As such the value of these materials is estimated as a proportion of value of all material inputs which is 30 per cent in 1980-81. This proportion is based on the information obtained from NBO, CPWD and CBRI for the bench mark year. For other years, the proportion is adjusted for relative movement of prices of other construction materials as compared with the prices of five basic materials otherwise covered.

9.13 Similarly in the case of inputs of factor payments going into construction, the information available from CPWD, NBO and survey results is utilised for working out the value of construction due to this component, which is 47.5 per cent of the value of all material inputs in 1980-81.

9.14 To take account of the differential movements of prices of other construction materials and factor inputs, the base year ratios are adjusted for relative movements in the index of wages of construction workers and the composite index of prices of construction materials to obtain the corresponding rates in other years. The composite index of prices of construction materials is prepared using the price indices of the basic construction materials viz., cement, iron and steel, bricks, timber and round wood and fixtures and fittings with the corresponding values of inputs in the base year (1980-81) as weights. The index of wages of construction workers comprising carpenters, masons and unskilled labour is obtained as the weighted index of wages of rural and urban construction workers with the corresponding values of construction in the two areas in the base year as weights.

Value of output of labour intensive kutcha construction

9.15 The labour intensive kutcha construction undertaken in the public sector, private corporate sector and household sector are prepared separately by expenditure approach.

Public sector

9.16 On the basis of discussions with the Officers of the State Governments, such labour intensive construction in respect of public sector, besides afforestation and re-afforestation, relates to the categories of kutcha construction like soil conservation and area development, about 15 per cent of capital expenditure on other construction comprising of bunding, field drains, kutcha bridges, etc. in the case of irrigation, expenditure on roads and buildings and 50 per cent of other construction in the case of forestry. Data on such expenditure are available from the annual budget documents.

Private corporate sector

9.17 Estimates of construction in plantations in the private corporate sector are prepared on the basis of annual data on area of extensions, replacements and replantations available in the annual reports of Tea, Coffee and Rubber Boards as well as data on the cost of plantations as obtained from the respective Boards. However, in the case of cost data not becoming available for a particular year, the current estimates are obtained by moving the latest available estimates with the help of quantum index based on area on extensions, replacements etc., duly superimposed by the index of daily wages of rural unskilled workers.

Household sector

9.18 In the case of household sector, the estimates are based on the data thrown by the RBI's decennial survey AIDIS for 1981-82. The survey results provide data relating to fixed capital expenditure and expenditure on normal repairs and maintenance by the households separately for residential buildings, non-residential buildings and other construction both for rural and urban areas. But this expenditure is not available distinctly by pucca and kutcha in respect of residential/non-residential buildings and wells. Therefore, having estimated the total expenditure under different categories of construction for the survey year 1981-82 and for other years using relevant indicators for such categories, ratios based on NSSO reports are then used to estimate the components of kutcha construction as the components of pucca construction have already been estimated under commodity flow approach. The proportions and the sources used to obtain the corresponding estimates under different categories of construction are discussed in the following paragraphs.

9.19 **Rural residential buildings/houses:** Estimates for rural residential housing have been prepared using the results of AIDIS, 1981-82. The survey report gives estimates of fixed capital expenditure and expenditure on normal repair and maintenance in residential buildings for the year 1981-82. Such annual estimates for 1980-81 and subsequent years are obtained using combined index of net annual additions in the number of rural residential buildings (based on 1971 and 1981 population census data on rural occupied dwellings) and cost of construction of rural houses. The proportion of kutcha construction is determined on the basis of information relating to expenditure on construction of houses in rural areas available from NSSO report No.97, 'Tables with Notes on Capital Formation' (Rural), 15th round, 1959-60 (NSSO,1965). According to these results only 72 per cent of the total expenditure on new construction & repairs & maintenance relates to pucca construction and is already covered by the commodity flow approach. Accordingly 28 per cent of the total expenditure on construction of rural residential houses has, therefore, been taken as the measure of expenditure of fixed capital formation and repair and maintenance in rural residential houses of labour intensive type, i.e., unaccounted in the commodity flow approach. In the absence of current data on proportions of labour intensive construction, the ratio based on above mentioned NSSO report is assumed to hold good over the years.

9.20 **Urban residential buildings/houses:** Estimates for urban residential housing are also based on the results of AIDIS, 1981-82. The survey report gives estimates of fixed capital expenditure and expenditure on repair and maintenance in urban residential houses for the year 1981-82. Such annual estimates for 1980-81 and subsequent years are obtained using combined index of net annual additions in the number of urban residential buildings (based on 1971 and 1981 population census data on urban occupied dwellings) and cost of construction of urban houses. Information available in the NSSO Report No.136 'Tables with Notes on Capital Formation' (Urban), 17th Round, 1961-62 (NSSO, 1969) on expenditure in construction shows that 20 per cent of total value of construction is of labour intensive type. This proportion has, therefore, been applied on the annual estimates of expenditure on new construction and repairs and maintenance under this category to obtain the measure of the labour intensive type of construction.

9.21 **Rural/urban non-residential buildings and other construction works:** The estimates of the value of household construction consisting of rural and urban non-residential buildings and other construction works have been prepared using the results of AIDIS, 1981-82 separately for the pucca construction and kutcha construction.

9.22 **Rural non-residential buildings:** As in the case of residential buildings using the data contained in NSSO Report No.97 'Tables with Notes on Capital Formation', (Rural) 15th Round, 1959-60 (NSSO, 1965), 28 per cent of fixed capital formation and expenditure on repairs and maintenance under this category has been treated as unaccounted for in the commodity flow approach and, therefore, of the labour intensive type.

9.23 **Urban non-residential construction:** On the basis of the details available in the NSSO Report No.136, 'Tables with Notes on Capital Formation', (urban), 17th Round: 1961-62 (NSSO, 1969) the value of urban household non-residential construction and repairs and maintenance relating to labour intensive kutcha construction is taken to be 20 per cent.

9.24 **Rural and Urban other construction works:** The estimated total value of such fixed capital formation and expenditure on repairs and maintenance excluding pucca wells is treated as labour intensive. 'Other construction works' include reclamation of land, bundings and other land improvement, digging of wells, development of other irrigation resources, afforestation, re-afforestation and laying of new orchards and plantations both in the urban and rural sectors of the economy. Value of all these items excepting a part of the construction of wells (attributable to pucca wells) forms part of investment in labour intensive kutcha construction. The estimates of wells as given in AIDIS, 1981-82 have been split up into 'pucca' and 'kutcha' construction on the basis of information available in Season and Crop Reports of various State Governments on masonary and non-masonary wells and the relative values of these two types of wells have been determined on the basis of the estimates of cost of wells given in the Report of the Working Group for Formulation of Proposals for Minor Irrigation Works for the Fourth Plan. These exercises suggested that of the total value of construction of wells, two seventeenths related to kutcha construction. Further, for the category of rural/urban non-residential buildings and other construction (kutcha) as discussed above, the estimated fixed capital expenditure and expenditure on repairs and maintenance are first prepared for the survey year 1981-82. For the year 1980-81 and the years subsequent to 1981-82, the estimates have been obtained using the combined index of agricultural and industrial production (weights being in the ratio of 9:1) and cost of construction of rural/urban non-residential buildings and other construction works for kutcha construction.

Value added from construction

9.25 For pucca construction, having estimated the value of material inputs by commodity flow-approach, the GVA is taken to be 47.5 per cent of the value of material inputs in 1980-81. Incidentally, the proportion of 60 per cent in 1970-71 after adjustment for relative movement in the index of wages of construction workers also works out to about 47.5 per cent in 1980-81. For other years, as already discussed in para 9.14, this proportion is adjusted for relative movement in the index of wages of construction workers as compared to the composite index of prices of construction materials to account for year to year changes. In case of all labour intensive kutcha construction, the GVA is determined taking 75 per cent of the value of output on a uniform basis. The sum of the two i.e., GVA from construction based on commodity flow approach and GVA from construction based on labour intensive kutcha construction gives the total GVA from construction. The details of estimates of value added for 1980-81 are given in Table 9.7.

Estimates at Constant Prices

9.26 The current price estimates of GVA by types are converted to constant prices by using appropriate deflators given in Table 9.6 for different types of construction works specially

prepared for the purpose. The sum of value added for various components of construction thus obtained gives the total value added from construction at 1980-81 prices.

Quality and limitations of Data base

9.27 The proportions of GVA to value of output for various types of construction works are not based on satisfactory data. Because of the wide diversity in the types of construction even within the broad groups of pucca and kutcha construction, the proportions of GVA to the total value of construction for different types are likely to vary. It is desirable that the different types of construction are classified into homogeneous groups and the proportion of value added for each group is worked out on a more satisfactory basis.

TABLE 9.1: Value of cement used in Construction

Item	Unit	1980-81
(1)	(2)	(3)
1. Total dispatches of cement including imports	000'tonnes	21414
1.1 Under rate contract		9475
1.2 Other than rate contract		4106
1.3 Free sale		7833
2. Cement used as input in other industries(8.089%)	000'tonnes	1732
2.1 Under rate contract		N.A.
2.2 Other than rate contract		596
2.3 Free sale		1136
3. Cement available for construction	000'tonnes	19682
3.1 Under rate contract		9475
3.2 Other than rate contract		3510
3.3 Free sale		6697
4. Prices of cement	Rs. per tonne	
4.1 Under rate contract		453.63
4.2 Other than rate contract		487.52
4.3 Free sale		516.88
5. Value of cement	Rs. Lakh	94708
5.1 Under rate contract		42981
5.2 Other than rate contract		17112
5.3 Free sale		34615
6. Trade and transport charges (2 % of item 5)	Rs. Lakh	1894
7. Value of cement used in construction (5+6)	Rs. Lakh	96602
8. Ex-factory value of cement products-ASI	Rs. Lakh	23724
9. Excise duty on cement products	Rs. Lakh	2084
10. Ex-factory value of cement products including excise duty (8+9)	Rs. Lakh	25808
11. Trade and transport charges(25 % of item 10)	Rs. Lakh	6452
12. Value of cement products at site(item 10+11)	Rs. Lakh	32260
13. Total value of cement including cement products used in construction (items 7+12)	128862	

TABLE 9.2 : Value of iron and steel used in Construction

(Rs. Lakh)

Item	1980-81
(1)	(2)
1. Value of iron and steel in construction	196225
2. Net imports	634
3. Import duties	1399
4. Value of iron and steel available for construction from small scale manufacturing sector	21891
5. Total value of iron and steel used in construction excluding trade and transport charges (items 1 to 4)	220149
6. Trade and transport charges (15% of item 5)	33022
7. Total value of iron and steel used for construction at site (item 5+6)	253171

TABLE 9.3: Value of timber and round wood used in Construction

Item	Unit	1980-81
(1)	(2)	(3)
1. Production of industrial wood	(000 cu.m.)	8713
(i) Timber (91.86 % of item 1)	(000 cu.m.)	8004
(ii) Round wood (7.95% of item 1)	(000 cu.m.)	693
2. Timber used in railway sleepers	(000 cu.m.)	299
3. Timber available for uses other than railway sleepers (1.i-2)	(000 cu.m.)	7705
4. Timber used in construction (48.5% of item 3)	(000 cu.m.)	3737
5. Price of timber used in construction	(Rs. per cu.m.)	2602.70
6. Value of timber (items 4x5)	(Rs. lakh)	97263
7. Trade and transport charges (7% of item 6)	(Rs. lakh)	6808
8. Value of timber at site (item 6+7)	(Rs. lakh)	104071
9. Value of railway sleepers	(Rs. lakh)	4102
10. Trade, transport and other charges (5% of item 9	(Rs. lakh)	205
11. Value of railway sleepers at site (9+10)	(Rs. lakh)	4307
12. Roundwood used in construction (38.3% of item 1(ii)	(000 cu.m.)	265
13. Price of roundwood used in construction	(Rs. per cu.m.)	746
14. Value of roundwood used in construction (12x13)	(Rs. lakh)	1977
15. Trade and transport charges (50% of item 14)	(Rs. lakh)	989
16. Value of roundwood at site(14+15)	(Rs. lakh)	2966
17. Value of veneer & plywood and their products	(Rs. lakh)	9538
18. Excise duty on veneer & plywood and their products	(Rs. lakh)	1558
19. Ex-factory value of veneer & plywood and their products (17+18)	(Rs. lakh)	11096
20. Value of veneer & plywood used in construction (1/3rd of item 19)	(Rs. lakh)	3699
21. Trade & transport charges(25% of item 20)	(Rs. lakh)	925
22. Value of veneer & plywood at site (20+21)	(Rs. lakh)	4624
23. Total value of timber & round wood including railway sleepers and veneer & plywood used in construction (items 8+11+16+22)	(Rs. lakh)	115968

TABLE 9.4 : Value of bricks and tiles used in Construction

Item	Unit	1980-81
(1)	(2)	(3)
1. Allocation of coal for brick burning	(000 tonnes)	2294
2. Total bricks produced*	(Lakh nos.)	143375
3. Price of bricks	(Rs.per lakh)	29088
4. Value of bricks & tiles produced in unorganised sector	(Rs. lakh)	45875
4.1 Small Scale enterprises (2X3)	(Rs. lakh)	41705
4.2 Others (10% of 4.1)	(Rs. lakh)	4170
5. Value of bricks & tiles produced in organised sector	(Rs. lakh)	20946
6. Trade & transport charges (25% of item 5)	(Rs. lakh)	5236
7. Total value of bricks and tiles at site (items 4+5+6)	(Rs. lakh)	72057

* 16 tonnes of coal need to be burnt for preparing 1 lakh of bricks & tiles.

TABLE 9.5 : Value of fixtures and fittings used in Construction

(Rs. lakh)

Item	1980-81
(1)	(2)
1. Fans & blowers	12050
2. Insulators(H.T. & L.T.)	4858
3. Electric cables & wires	39624
4. Water meters	244
5. House service meters	5138
6. Sanitary wares	1592
7. Total (items 1 to 6)	63506
8. Trade & transport charges (35% of item 7)	22227
9. Total value at site (items 7+8)	85733

TABLE 9.6 : Weights allotted to different indices in the preparation of deflators for various types of Construction

Indices	Pucca construction	Kutcha construction			
		Rural housing	Urban housing	Rural/urban non-residential buildings & other construction works	Others *
(1)	(2)	(3)	(4)	(5)	(6)
1. Wage rate index for rural construction workers	12	100			
2. Wage rate index for urban construction workers	88		100	29	
3. Wage rate index for rural unskilled labour				67	100

* Construction under the category 'Others' covers plantations and afforestation and other kutcha construction outside household sector.

TABLE 9.7 : Gross Value Added in Construction

(Rs. crore)

Item	1980-81
(1)	(2)
1. Pucca construction	4450
2. Kutcha construction	1664
2.1 Rural urban non-residential buildings & other construction works(new & repairs)	715
2.2 Rural residential buildings (new & repairs)	439
2.3 Urban residential buildings (new & repairs)	162
2.4 Plantation in private corporate sector	93
2.5 Govt. kutcha construction	255
3.Total gross value added (1+2)	6114