9.0 Introduction

Traditionally materials like clay, sand, stone, gravels, cement, brick, block, tiles, distemper, paint, timber, and steel are being used as major building components in the construction sector. All these materials have been produced from the existing natural resources and will have intrinsic distinctiveness for damaging the environment due to their continuous exploitation. Nevertheless, during the process of manufacturing various building materials, especially decomposition of calcium carbonate, lime and cement manufacturing, high concentration of carbon monoxide, oxides of sulphur, oxides of nitrogen and suspended particulate matter are invariably emitted to the atmosphere. Exposure to such toxic gases escaping into the environment does lead to major contamination of air, water, soil, flora, fauna, aquatic life finally influences human health and their living conditions.

Construction and demolition waste is generated whenever any construction/demolition activity takes place, such as, building roads, bridges; flyover, subway, remodelling etc. It consists mostly of inert and non-biodegradable material such as concrete, plaster, metal, wood, plastics etc. A part of this waste comes to the municipal stream.

These wastes are heavy, having high density, often bulky and occupy considerable storage space either on the road or communal waste bin/container. It is not uncommon to see huge piles of such waste, which is heavy as well, stacked on roads especially in large projects, resulting in traffic congestion and disruption. 3. (Bhattacharyya JK, Shekdar AV, Gaikwad SA.;2004).

Waste from small generators like individual house construction or demolition, find its way into the nearby municipal bin/vat/waste storage depots, making the municipal waste heavy and degrading its quality for further treatment like composting or energy recovery. Often it finds its way into surface drains, choking them. It constitutes about 10-20% of the municipal solid waste (excluding large construction projects).
9.1 Characteristics

This category of waste is complex due to the different types of building materials being used but in general may comprise the following materials: Major components Cement concrete, Bricks, Cement plaster, Steel (from RCC, door/window frames, roofing support, railings of staircase etc.) Rubble, Stone (marble, granite, sand stone) Timber/wood (especially demolition of old buildings) Minor components, Conduits (iron, plastic) Pipes (GI, iron, plastic) Electrical fixtures (copper/aluminium wiring, wooden baton, bakelite/plastic switches, wire insulation) Panels (wooden, laminated) Others (glazed tiles, glass panes) 9.(Saxena M, Sorna Gowri V, Prabakar J, Sangeeta, T.;2000).

9.1.1 Storage of Constructional and Demolition

These wastes are best stored at source, i.e., at the point of generation. If they are scattered around or thrown on the road, they not only cause obstruction to traffic but also add to the workload of the local body. 4.(Dak H.;2000) All attempts should be made to stick to the following measures: All construction/demolition waste should be stored within the site itself. A proper screen should be provided so that the waste does not get scattered and does not become an eyesore. Attempts should be made to keep the waste segregated into different heaps as far as possible so that their further gradation and reuse is facilitated. Material, which can be reused at the same site for the purpose of construction, levelling, making road/pavement etc. should also be kept in separate heaps from those, which are to be sold or landfilled. The local body or a private company may arrange to provide appropriate number of skip containers/trolleys on hire which may be parked at the site and removed with skip lifters or tractors as the case may be.

Whenever a new streamlined system is introduced in a Municipality, the local body may consider using its old vehicles, especially, tractors and trailers or old lorries or tippers for this purpose. For large projects involving construction of bridges, flyovers, subways etc., special provision should be made for storage of waste material. Depending on the storage BilaspurCity, movement of the waste has to be planned accordingly. Otherwise, it would result in job constraint as well as traffic bottlenecks.

This subject is often neglected in case of repair/maintenance of roads, water pipes, underground telephone and electric cables etc. It is not uncommon to see that after such work, the waste remains piled for months on the roads or pavements. The concerned departments and contractors must co-ordinate with the Municipality for removal of the debris generated. The Municipality while giving permission for such work should clearly sort out the issue of removal of the debris and should insist that immediately after the job is over, the road should be repaired and brought back to its normal shape.

9.1.2 Collection and Transportation

If the construction debris is stored in skips, then skip lifters fitted with hydraulic hoist system should be used for efficient and prompt removal. 4.(Dak H.;2000) In case, trailers are used, then tractors may remove these. For handling very large volumes, front-end loaders in
combination with sturdy tipper trucks may be used so that the time taken for loading and unloading is kept to the minimum. For small generators of construction debris, e.g., petty repair/maintenance job, there may be two options – (i) specific places for such dumping by the local body and (ii) removal on payment basis. In case of small towns where skips and tipping trailers are not available, manual loading and unloading should be permitted. Close co-ordination between the Sanitary Department, Municipal Engineering Department and Town Planning Department is essential if there is no consolidated Solid Waste Management Department to take care of the construction and demolition waste in addition to other municipal garbage.

9.1.3 Recycling Reuse

Use of these materials basically depends on their separation and condition of the separated material. A majority of these materials are durable and therefore, have a high potential of reuse. It would, however, be desirable to have quality standards for the recycled materials. Construction and demolition waste can be used in the following manner: Reuse (at site) of bricks, stone slabs, timber, conduits, piping railings etc. to the extent possible and depending upon their condition. The material which cannot be used at the site due to design constraint or change in Plastics, broken glass, scrap metal etc. can be used by recycling industries. Rubble, brick bats, broken plaster/concrete pieces etc. Can be used for building activity, such as, levelling, under coat of lanes where the traffic does not constitute of heavy moving loads. Larger unusable pieces can be sent for filling up low-lying areas. Fine material, such as, sand, dust etc. can be used as cover material over sanitary landfill.

Usually generate huge quantities of wastes because of large-scale building and other developmental activities. They may identify suitable sites where such waste can be temporarily stored and some physical treatment can be carried out. These sites may have the following features:

Compared to the general waste treatment/disposal/landfill site such sites may be suitably located near the municipal boundaries, because the inert waste do not cause odour or pollution, provided adequate steps are taken to reduce dust and noise during handling. Since these wastes are heavy, their transportation cost can also be reduced to some extent if the distance to be carried is less. \(3.\text{(Bhattacharyya JK, Shekdar AV, Gaikwad SA.;2004).}\)

At this site, different kinds of waste should be kept in separate heaps. Arrangement for size grading can also be planned so that reuse is facilitated. This can be simply done by erecting sturdy metallic screens of different sizes at an angle and putting the waste over them with the help of a front-end loader. The graded material should be kept in separate heaps with appropriate label and direction. Sale or auction of these materials can also be planned from time to time.

9.1.4 Disposal

Being predominantly inert in nature, construction and demolition waste does not create chemical or biochemical pollution. Hence maximum effort should be made to reuse and recycle
them as indicated. The material can be used for filling/levelling of low-lying areas. In the industrialised countries, special landfills are sometimes created for inert waste, which are normally located in abandoned mines and quarries. 2.(Agrawal A, Sahu KK, Pandey BD;2004) The same can be attempted in our country also for cities, which are located near open mining quarries or mines where normally sand is used as the filling material. However, proper sampling of the material for its physical and chemical characteristics has to be done for evaluating its use under the given circumstances.

9.1.5 Planning and Management Aspect

The concerned civic authorities should make a plan for gainful use of construction debris. The low lying areas, which need to be filled up for the purpose of building activity, may be mapped and a contingency plan prepared so that whenever a demolition or construction activity takes place, its debris can be directed to such places in order of priority. However, such activity should be planned and implemented strictly under supervision and approval of the concerned authority.

9.1.6 Institutional and Regulatory Aspect

There should be a proper institutional mechanism to take care of the collection, transportation, intermediate storage (if necessary utilisation and disposal of the construction and demolition waste. In a number of municipalities, the Sanitary Department or the Health Department is responsible for the municipal garbage whereas the Engineering or the Planning Department is responsible for construction and demolition waste. Under such circumstances, it is extremely important that either the Solid Waste Management Department is made responsible for collection of construction and demolition waste or these departments work in close co-ordination. It is essential that proper accountability is fixed and official information is readily available regarding day to day situation.

Private enterprise can be gainfully employed for the collection and transportation of the waste. Strict control of the concerned civic authorities is essential. If the Municipality has suitable vehicles and containers, these can be leased to the private enterprises. There must be proper contract agreement protecting the genuine interests of the private enterprise and the civic authorities. Thus the following four options are possible:

1. The total activity may be contracted out.

2. Only vehicles may be leased out by the civic body to the private contractor for transport of debris with his own labour, i.e., labour contract.

3. The vehicles may be hired by the local body from private sources for transport of debris with municipal labour.

4. The total activity may be carried out by the Department, i.e., the Municipality. The civic authority should consider the following points and after deliberations get them approved by the competent authority, except the those which already exist in their municipal act. The civic
authority should notify that no person should dispose of construction/demolition waste on the streets/pavements/storm drainage/open land belonging to the Municipality or the government.

In case such waste is dumped on a private land, the owner of such land would be accountable for the act and would be held responsible for any degradation of the surrounding environment or causing of any pollution. Such waste should be stored within the premises till they are removed from the site to a place notified/permited by the local body 3. (Bhattacharyya JK, Shekdar AV, Gaikwad SA.; 2004).

The primary responsibility for removal of such waste would be that of the generator of such waste. The civic authority would charge suitably (at least full cost recovery) if they provide containers on hire and provide service for removal of the waste. In such case the local body would become the owner of the waste and would have the right to sale or auction the same.

The generator of waste should inform the concerned civic authority in writing in advance before undertaking such activity and also deposit such fees as necessary according to the notifications of the Municipality by way of container rent, stacking (on a public road/place) or hauling charges. There should be provision of suitable penalty clause by way of moderate to heavy fines etc. (depending on the severity of the offence) for violation of these rules and also for littering of construction debris.

In case of new construction, the advance is to be deposited with the application for sanction of the building plan. 2. (Agrawal A, Sahu KK, Pandey BD; 2004) The charges would be notified by the civic authority and would be refundable after due deductions in case of compliance of the stipulated laws. In case of any default, the whole amount would be confiscated.

These rules/notifications would also be valid for Government, Semi-Government and Public Sector Departments.

9.1.7 Construction and Demolition Debris

Construction and demolition (C&D) debris is excess material produced during new construction, renovation, and demolition of buildings and structures. This debris is made up of materials such as asphalt, brick, concrete, masonry, lumber, shingles, roofing materials, glass, plastics, aluminum, steel, architectural elements, drywall, insulation, wiring, plumbing and electrical fixtures, vinyl and aluminum siding, corrugated cardboard, soil, rocks, tree stumps and other landscaping. Standard construction and demolition operations haul and dispose these materials en masse to separation and transfer facilities or to permitted landfills. Some C&D facilities may separate materials on site for further processing and recycling. Others simply add the materials to the heaping piles of waste in the landfill. Of the total recorded waste stream, 30-40% is sent to municipal landfills, 35-45% is sent to specialty C&D landfills, and 20 to 30% of C&D debris is recycled.

9.2 Economic Development and C&D Recycling

There are community-level benefits of recycling and reuse of C&D debris. Diversion of materials through recycling or salvage supports economic development and the improvement of
communities. Sometimes referred to as waste-based development, recycling and reuse industries create jobs and revenue, provide small business development opportunities and job training outlets, and reduce landfill expansion needs. C&D recycling can be used as part of a larger industrial development effort to bring higher wage jobs to a region. Studies conducted by the Waste to Work Partnership and the US Economic Information Study indicate manufacturing of secondary materials increases the economic impact of recycling collection and processing fourfold. Wage rates in manufacturing are typically higher than those wages in collection or processing. The collection and processing phases do provide low skilled and entry-level workforce opportunities in the region.

9.2.1 Current Trends in Reuse and Recycling of C&D Waste

To a certain extent, the reuse and recycling of construction and demolition waste maintains a long tradition in the construction industry. For decades, asphalt has been reused in transportation projects, rubble has been used for fill, and metal has been melted down for reuse. What is changing, however, is the increase in the number and types of construction materials that can be reused and recycled. Innovative entrepreneurial activity and progressive leadership in local governments have stimulated much of this trend. The following section provides basic information on standard C&D recycling products as well as innovative measures to support additional material diversion.

Standard C&D recycling practice involves the three types of recycling. The first is the direct reuse of materials where C&D materials are salvaged in usable form. Windows, doors, bricks and hardware can be removed and reused on site or sold to a used building materials retailer. 1. (Asokan P.; 2004) Some salvaged building materials may demand high values, such as antiques or architecturally significant components. Other salvaged materials may target remodelers and builders who are looking for inexpensive building materials. The second type of recycling involves physical alteration of the materials. For example, crushed concrete is used for granular sub-base layers in road pavement construction or drainage and excavation fill applications. Crushed brick and concrete may be used as fill on construction sites. Wood maybe chipped and used as mulch or soil stabilizer during construction. A third recycling method is the remanufacture of products. In this case, salvaged wood may be re-planed as flooring or furniture. Recycled wood scraps can be used to produce composite lumber and plastic. Glass can be transformed into fiberglass or extruded into glass beads.

9.3 CONSTRUCTION WASTE MANAGEMENT PART

- **Construction Waste:** Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

- **Demolition Waste:** Building and site improvement materials resulting from demolition or selective demolition operations

- **Disposal:** Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction

- **Diversion:** Avoidance of demolition and construction waste sent to landfill or incineration. Diversion does not include using materials for landfill, alternate daily cover on landfills, or materials used as fuel in waste-to-energy processes
• **Hazardous:** Exhibiting the characteristics of hazardous substances, i.e., ignitability, corrosiveness, Bilaspur City or reactivity

• **Recycle:** Recovery of demolition or construction waste for subsequent processing in preparation for reuse

• **Recycling:** The process of sorting, cleansing, treating, and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

• **Salvage:** Recovery of demolition or construction waste and subsequent reuse or sale in another facility

• **Reuse:** Recovery of demolition or construction waste and subsequent incorporation into the Work

• **Source Separation:** The act of keeping different types of waste materials separate beginning from the first time they become waste

• **Toxic:** Poisonous to humans either immediately or after a long period of exposure

• **Trash:** Any product or material unable to be reused, returned, recycled, or salvaged

**Waste:** Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

### 9.4 PERFORMANCE REQUIREMENTS

- The Owner has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.

- Of the waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills or incinerators shall be minimized, thereby reducing disposal costs.

- Develop a construction waste management plan that results in end-of-Project rates for salvage/recycling of 95 percent by weight of construction and demolition waste.

- **Salvage/Recycle Requirements:** Salvage and recycle as much non-hazardous demolition and construction waste as possible, including the following materials:

  - **9.4.1 Demolition Waste:** Asphaltic concrete paving, Concrete, Concrete reinforcing steel, Brick, Concrete masonry units, Wood studs, Wood joists, Plywood and oriented strand board, Wood panelling, Wood trim, Structural and miscellaneous steel, Rough hardware, Roofing, Insulation, Doors and frames, Door hardware, Windows, Glazing, Metal studs, Gypsum board, Acoustical tile and panels, Carpet, Carpet pad, Demountable partitions, Equipment, Cabinets, Plumbing fixtures, Piping, Supports and hangers, Valves, Sprinklers, Mechanical equipment, Refrigerants, Electrical conduit, Copper wiring, Lighting fixtures, Lamps, Ballasts, Electrical devices, Transformers
9.4.2 SUBMITTALS

Construction Waste Management Plan (CWMP): It is the intent of this specification to maximize the diversion of demolition and construction waste from landfill disposal. Accordingly, not more than 30 days after receipt of Notice to Proceed and prior to the generation of any waste, prepare and submit a draft Construction Waste Management Plan including, but not limited to, the following:

1. Procedures for Recycling/Reuse Program to divert a minimum of 95% (by weight) of construction and demolition waste from landfill disposal, including waste resulting from demolition of any existing building and site paving scheduled for demolition; any site paving is required to be ground on site and reused as granulated fill on site 8. (Sengupta J., 2002).

2. Approval of the Contractor’s CWMP shall not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures.

B. Submit a 3-ring binder with calculations on end-of-project recycling rates, salvage rates, and landfill rates itemized by waste material, demonstrating that a minimum of 75% of construction wastes were recycled or salvaged and diverted from landfill. Include documentation of recovery rate (if commingled), waste hauling certificates or receipts, and a brief narrative explaining how and to where each waste type has been diverted.

C. Construction Waste Management Plan: Submit four copies of plan within 45 days of date established for the Notice to Proceed.

D. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit four copies of report. Include separate reports for demolition and construction waste. Include the following information:

1. Material category
2. Generation point of waste
3. Total quantity of waste in tons
4. Quantity of waste salvaged, both estimated and actual in tons
5. Quantity of waste recycled, both estimated and actual in tons
6. Total quantity of waste recovered (salvaged plus recycled) in tons
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste
8. Include up-to-date records of donations, sales, recycling and landfill/incinerator manifests, weight tickets, hauling receipts, and invoices.
E. Waste Reduction Calculations: Before request for Substantial Completion, submit four copies of calculated end-of-project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work. Complete a table similar to the example below.

F. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax-exempt.

G. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax-exempt.

H. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

I. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills (or transfer stations) and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

9.5 QUALITY ASSURANCE

- Regulatory Requirements: Comply with all applicable requirements of North Carolina Department of Environment, Health, and Natural Resources Policy Memorandum 16 Concerning Management of Construction, Demolition, Land Clearing, Inert, and Yard Trash Debris and any and all subsequent modifications and amendments to same. Comply with all applicable local ordinances and regulations.

- Waste Management Meetings: Conduct an initial conference at Project Site to comply with requirements in Division 1 Section “Project Management and Coordination.” Contractor shall include discussions on

  (i) Review and discuss waste management plan including responsibilities of the Waste Management Coordinator.

  (ii) Review requirements for documenting quantities of each type of waste and its disposition.

  (iii) Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.

  (iv) Review procedures for periodic waste collection and transportation to recycling and disposal facilities.

  (v) Review waste management requirements for each trade.

9.6 CONSTRUCTION WASTE MANAGEMENT PLAN

- General: Develop and implement a CWMP consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use the same units of measure
Draft Construction Waste Management Plan: Within 30 days after receipt of Notice to Proceed, or prior to any waste removal, whichever occurs sooner, the Contractor shall submit to the Owner and Architect a Draft Waste Management Plan.

Final Construction Waste Management Plan: Once the Owner has determined which of the recycling options addressed in the draft Waste Management Plan are acceptable, the Contractor shall submit, within 10 calendar days, a Final Waste Management Plan.

Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

Landfill Options: Indicate the name of the landfill(s) and/or transfer station(s) and/or incinerator(s) where trash will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all Project waste in the landfill(s).

Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, reused, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

(i) Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.

(ii) Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.

(iii) Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.

(iv) Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

(v) Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

(vi) Handling and Transportation Procedures: Describe method that will be used for separating recyclable waste, including sizes of containers, container labeling, and designated location on Project Site where materials separation will be located (Gupta TN.;1998).

(vii) Materials: The following list of required materials, at a minimum, must be included for salvaging/recycling:

1. Cardboard
2. Clean dimensional wood
3. Beverage and food containers
4. Paper
5. Concrete
6. Concrete Masonry Units (CMUs)
7. Asphalt: Include the approximate weight of the asphalt paving to be crushed and utilized as granulated fill from the existing paving as a component of waste material diverted from the landfill.
8. Ferrous and non-ferrous metals (banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminium, copper, zinc, lead, brass, and
9. Stretch and shrink wrap
10. Gypsum wallboard
11. Paint containers and other clean, empty plastic containers

(viii) **Meetings:** Provide a description of the regular meetings to be held to address waste management.

(ix) **Materials Handling Procedures:** Provide a description of the means by which any waste materials identified will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.

(x) **Transportation:** Provide a description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centres or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials.

### 9.7 RECYCLING DEMOLITION WASTE

**A. Asphaltic Concrete Paving:** Break up and transport paving to asphalt-recycling facility or recycle on-site into new paving. (Haque A, Mujtaba IM, Bell JNB.;2000).

**B. Concrete:** Remove reinforcement and other metals from concrete and sort with other metals.
   1. Pulverize concrete to maximum 4-inch (100-mm) size.
   2. Crush concrete and screen to comply with requirements in Division 2 Section “Earthwork” for use as satisfactory soil for fill or subbase.

**C. Wood Materials:** Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, and panel products for reuse and/or recycling. Separate wood material treated with heavy metal preservatives for reuse or landfill disposal.

**E. Metals:** Separate metals by type.
   - Structural Steel: Stack members according to size, type of member, and length.
   - Remove and dispose of bolts, nuts, washers, and other rough hardware.
   - Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts for recycling into asphalt paving or by other recycling entities.
   - Gypsum Board: Stack large, clean pieces on wood pallets and store in a dry location for recycling off-site. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

**H. Acoustical Ceiling Panels and Tile:** Stack large, clean pieces on wood pallets and store in a dry location. Separate suspension system, trim, and other metals from panels and tile sort with other metals.

**I. Carpet and Pad:** Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
   - Store clean, dry carpet and pad in a closed container or trailer provided by a carpet recycler.
or manufacturer-related carpet reclamation agency.

J. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

K. Plumbing Fixtures: Separate by type and size.

L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

M. Lighting Fixtures: Separate lamps by type and protect from breakage.

N. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panel boards, circuit breakers, and other devices by type.

9.8 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.


3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project Site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood. (Haque A, Mujtaba IM, Bell JNB; 2000).

4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees on-site. Comply with requirements in Division 2 Section “Exterior Plants” for use of chipped organic waste as organic mulch.

C. Wood Materials: Clean Cut-Offs of Lumber: Grind or chip into material appropriate for mulch or erosion control. Lumber Treated with Heavy-Metal Preservatives: Do not grind, chip, or incinerate; must be reused or land filled.

D. Gypsum Board: Stack large, clean pieces on wood pallets and store in a dry location for recycling and/or reuse on-site or off-site. (Garg M, Singh M, Kumar R; 1996) Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding. Comply with requirements in Division 2 Section “Exterior Plants” for use of clean ground gypsum board as inorganic soil amendment.

E. Miscellaneous: Anything called out to be ground and used on site should utilize an on-site grinder. Grinder should be able to accommodate a variety of materials including masonry, asphalt shingles, wood, and drywall.

9.9 DISPOSAL OF WASTE

Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project Site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on site. Remove and transport debris in a manner that will prevent
spillage on adjacent surfaces and areas. Do not burn or bury waste materials on or off site. Appropriate on-site topical application of ground gypsum or wood, or use of site paving as granulated fill is considered reuse, not waste.

9.10 Conclusion

During different industrial, mining, agricultural and domestic activities, India produces annually about 260 MT of solid wastes as by-products, which pose major environmental and ecological problems besides occupying a large area of land for their storage/disposal. Looking to such huge quantity of wastes as minerals or resources, there is a tremendous scope for setting up secondary industries for recycling and using such solid wastes in construction materials. However, environment friendly, energy-efficient and cost effective alternative materials developed from solid wastes will show good market potential to cater to people’s needs in rural and urban areas.

To effectively utilise these wastes as a raw material, filler, binder and additive in developing alternative building materials, detailed physical-chemical, engineering, thermal, mineralogical and morphological properties of these wastes are to be evaluated and accurate data made available. In order to maximize the use of alternative building materials developed from different types of solid wastes and to increase the production of lab scale processes, technology-enabling centres are needed to be set-up to facilitate entrepreneurs for effective commercialisation. 4.(Dak H.;2000) Durability and performance of the newer products and dissemination of technologies emphasising costs-benefits analyses and life cycle assessment report will significantly contribute to successful commercialisation of innovative processes. Inclusion of industrial waste-based newer building materials, emphasizing their environmental significance in the curriculum at higher education level and practical applications of wastes in construction sector will give fillip to such technology promotion.
References