Handbook of
Clean Construction Practices

The Energy and Resources Institute
Creating Innovative Solutions for a Sustainable Future

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
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Swiss Agency for Development and Cooperation SDC

CAP India
Clean Air Project in India

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Purpose

Construction is a significant contributor to air pollution in Indian cities. Dust emissions from construction sites negatively impact human health and the surrounding ecosystem. Construction activities also emit chemicals and toxic gases, which may enter the body through respiration. This handbook aims to develop user-friendly guidelines for builders to adopt at the construction site to mitigate dust emissions and to provide a checklist to the regulatory body to ensure the implementation of procedures at the construction site.

This handbook has been prepared under the Clean Air Project in India (CAP India), which forms a part of the National Clean Air Programme (NCAP) launched by the Government of India in January 2019. The Energy and Resources Institute (TERI) is facilitating the development of the Clean Air Action Plan (CAP) for Lucknow, with support from the Uttar Pradesh Pollution Control Board (UPPCB), Directorate of Environment (DoE), UP, Dept. of Environment, Forest and Climate Change, UP and Swiss Agency for Development and Cooperation (SDC).

Introduction

According to a recent report released by Bloomberg using the IMF database stated that India has overtaken the UK to become the world's fifth-largest economy and is now behind only the US, China, Japan and Germany. This growth can be directly and indirectly associated with large growth in the construction sector over the past decade. It has accounted for around 40% of the development investment during the past 50 years (Yadav et al., 2015). With growth of construction activity across the country coupled with increasing air pollution levels in urban centres, the construction industry cannot ignore the pollutants generated at their sites.

The construction activities are significant contributor to air pollutants. As per the national emission inventory prepared by TERI for the year 2016, construction sector contributed 21% of PM_{10} emissions in the country (TERI, 2021). Organizations within the sector have a shared responsibility to limit the amount they produce. The air pollutants mainly emitted from construction sector is PM and it depends on the scale of activity, i.e., excavation, demolition or construction of the site till the completion of the building. According to recent source apportionment study of Lucknow done by TERI, about 4% of the total PM_{10} emissions in the Lucknow district came from construction sector while the share was 5% in Lucknow city among all the major sources.

Common construction activities that contribute to air pollution include:
Dust generated by various construction activities, heavily contribute to the air pollution in the Indian cities. The primary activities that cause air pollution on a construction site include:

» **Land clearing and demolition activities**
To make way for construction, some amount of land has to be cleared and dug up. This results in huge dust emissions not just during the digging

up phase but also during the transportation and storage of soil. Further during the construction of buildings, high level of dust is generated when land is disrupted and existing buildings or parts are demolished.

» **Vehicles and machinery on site**

Number of vehicles operate at a construction site based on the scale of construction activity. The movement of vehicles at construction sites result in re-suspension of dust particles in the air along with the tail pipe emissions. The movement of vehicle can also spread the construction material outside the construction site, which can later become air borne. Additionally, lot of heavy and light machineries are involved and are running for long time which result in PM, CO, NO_x, SO_x and NMVOC emissions. At most of the construction sites, heavy vehicle movement on unpaved roads contribute to most of the particulate matter emissions from construction (Table 1).

Table 1: Sources of emissions at construction sites

S.No.	Publication	Year	Place	Major source of emissions/ Remarks
1	Muleski et al., 2005	1998–2001	Menlo and Beloit, KS, USA	The observed $PM_{2.5}$: PM_{10} emission factor ratios reflected the relative importance of the vehicle exhaust and the re-suspended dust components of each type of construction activity.
2	Qi et al., 2013	2013	Vanhankaupunginlahti, Finland	Study estimated that dust emission rate in the construction work was 22.86 kg TSP/d, 6 kg/d was from construction work and 16.86 kg/d was generated due to traffic on temporary roads.
3	Giunta et al., 2019	2019	Italy	Truck transit on paved and unpaved roads contributed 24% and 47% of PM_{10} emissions, respectively during the construction phase of an 18-km, three lane and dual carriageway motorway.
4	Yan et al., 2019	2017–2018	Qingyuan, China	The results showed that the average daily construction site makes the surrounding areas' concentration of TSP, PM_{10} and $PM_{2.5}$ increase by 42.24%, 19.76% and 16.27%, respectively. The proportion of TSP, PM_{10} and $PM_{2.5}$ in building construction dust is 1, 0.239 and 0.116, respectively. Construction vehicles were one of the main influencing factors for building construction dust.
5	Alshetty and Nagendra., 2022	2019–2020	Chennai, India	Study indicated that re-suspension of road dust due to movement of heavy duty trucks highly influence the PM concentrations in the surrounding environment of a construction site.

» **Handling storage and spillage of material**

Material handling is the process of moving, protecting, storing, and controlling materials throughout the construction process. On the other hand, material storage is a sub-section of the handling process. It involves holding construction materials in a safe place until these are required during the construction process. The handling and storage of construction material, would release a wide range of particle sizes, noxious vapours

and volatile organic carbons that could affect health and cause problems ranging from eye, nose and throat irritation besides affecting the respiratory system.

» **Other construction activities (cutting, drilling, grinding, scabbling, sand and grit blasting and façade cleaning)**

Construction dust originates from many types of activities such as cutting, drilling, grinding, scabbling, blasting and façade cleaning. These activities release the calcium element of $PM_{2.5}$, which is a component of construction dust and an environmental pollutant (Xing et al., 2018). Cutting and drilling activities can increase the particle concentration as high as 14 times the background level (Azarmi et al., 2014).

The air pollution management at individual construction site has become incredibly important. This will not just aid in improving the air quality of the nearby areas and reduce the negative impacts on site workers, local residents and the environment but also enforcing pollution prevention strategies can have significant positive impacts on perception of the company and the final constructed project. We have outlined a list of mandatory and voluntary suggestions to limit pollution generated during the construction activities:

Table 2: Land clearing and demolition activities

S.No.	Process	Control measures	Reference	Voluntary/ Mandatory	Efficacy based on Literature
1	Land clearing	1. Provide barricading (wind barriers) along the site boundary. The barricading should be at least 3 m high than the maximum mound height of any construction material or waste stored near the site boundary. 2. Material used for wind break should have 50% porosity. 3. For construction projects, longer than 1 year, barricading can also be done with trees which can develop more than 10 feet height in duration of one year would capture most of the emissions (especially PM_{10}) escaping from construction sites.	GRIHA 2019; WRI, 2020; EPA, 2021	Norm 1 and 2 is mandatory	The effectiveness of wind breaks depends primarily on their size and permeability. As a general rule, for each foot of vertical height, an 8- to 10-foot deposition zone develops on the leeward side of the barrier.
2	Construction phase	1. Construction sites are prone to soil erosion and sedimentation, which can be harmful to the environment and neighbouring areas. Therefore, it's important to construct sedimentation tanks and soil erosion channels to prevent these issues. Some general steps to construct sedimentation tanks and soil erosion channels in a construction site have been provided in Annexure I.	GRIHA 2019; DoE, 2022	Norm 1 is mandatory	70–80%

Table 2: Land clearing and demolition activities

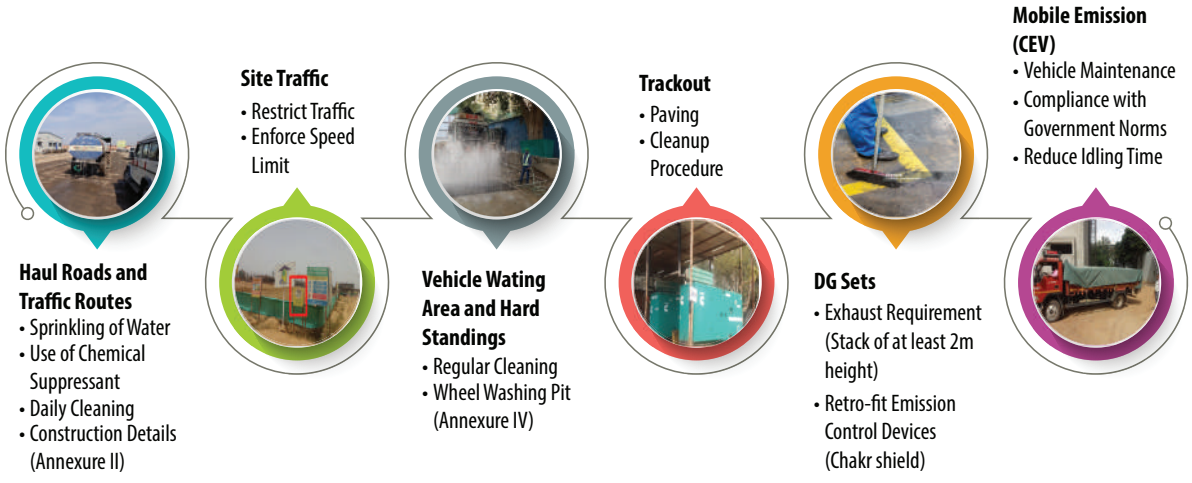
S.No.	Process	Control measures	Reference	Voluntary/ Mandatory	Efficacy based on Literature
3	Maintenance of top soil	1. When excavating top soil from a construction site, it's important to prevent air pollution and wind erosion while also maintaining soil fertility. One effective way to achieve this is through vegetation-based mulching. Instead of using non-organic materials, vegetation-based mulching involves planting grasses or other cover crops that will protect the soil from wind erosion and also add nutrients to the soil. All the excavated earth should be covered or mulched.	GRIHA 2019; MPCA 2019a; EPA, 2021	Norm 1 is mandatory	Mulch can reduce wind erosion by 75 to 95% compared to un-stabilized soils, depending on the type of mulch and the application rate (MPCA, 2019a). Mulch is effective on sites that will re-establish vegetation and in areas where slopes have less than 1 foot of elevation change for every 2.5 feet of horizontal change. Mulch can be effective in areas with steep slopes in combination with tackifiers or other stabilization methods.
4	Disposal of C&D waste	1. Compliance of CPCB C&D management rules	CPCB, 2016	Norm 1 is mandatory	NA

Land Clearing and Demolition Activities

Table 3: Control measures for vehicles and machinery at the site					
S.No.	**Process**	**Control measures**	**Reference**	**Voluntary/ Mandatory**	**Efficacy based on Literature**
1	Haul roads and traffic routes	1. Sprinkling water: The results ranged from a control efficiency of 74% for TSP for the three to four hours following the application of water at a rate of 2.08 L/m^2 to a control efficiency of 95% for TSP for 0.5 hours after the application of 0.59 L/m^2 (0.13 gallons/yd^2). Water used for sprinkling should be non-potable. 2. Use of chemical suppressant: Studies demonstrated the control efficiencies to be 95% for magnesium chloride and 70% for a petroleum derivative for controlling haul truck generated dust. 3. Frequency of cleaning will depend on site size, location and operation. However, cleaning should be carried out on a daily basis (working day) or more frequently if required. 4. Ensure that roads, vehicular pathways and pavement/footpath including kerb stone within site premises are constructed with one, or any combination. (Details in Annexure II)	Reed and Organiscak, 2007; Kukadia et al., 2003	2 & 4 Voluntary	74%–95%
		a. Bituminous road with plastic waste content b. Cast in-situ cement concrete road with fly ash content c. Concrete blocks with fly ash content d. Paver blocks containing C&D waste content e. Stones from India f. Any other product with recycled content			
2	Site traffic	1. Restrict general site traffic to watered or treated haul roads. Speed limits are an effective way to reduce air pollution on construction sites. Dust and other airborne pollutants are often generated by vehicles moving quickly over unpaved roads or loose soil, so reducing vehicle speed can help to minimize the amount of dust and other pollutants that are released into the air. The appropriate speed limit for a construction site will depend on a number of factors, including the size of the site, the type of vehicles being used, and the specific conditions of the site. However, some general guidelines for speed limits on construction sites are included in Annexure III. 2. Enforcing the speed limit through regular monitoring and enforcement by site managers or safety officers.	Reed and Organiscak, 2007; Kukadia et al., 2003	Mandatory	NA

Table 3: Control measures for vehicles and machinery at the site

S.No.	Process	Control measures	Reference	Voluntary/ Mandatory	Efficacy based on Literature
3	Vehicle waiting area and hard standings	1. Regular cleaning by brushing. 2. Spray regularly with water. 3. A vehicle washing facility at the entrance and exit of a construction site can have significant effects on air pollution. Vehicles entering and exiting the site can carry dust, dirt, and other pollutants on their tires and undercarriage, which can be released into the air as they drive. A vehicle washing facility can help to remove these pollutants from vehicles, reducing the amount of airborne particulate matter and other pollutants. In addition to creating a vehicle washing area, construction sites may also consider constructing a wheel washing pit. A wheel washing pit is a below-ground pit that vehicles can drive through to remove dirt and other debris from their tires and undercarriage. 4. Some steps to construct a wheel washing pit are given in Annexure IV.	GRIHA, 2019; MPCA, 2019b	Mandatory	Wheel washing racks, when properly installed, can remove 75% or more of sediment
4	Trackout	1. Paving - The paved surface must extend from the point of intersection with a paved public roadway at least 100 ft. back onto the site and have a width of at least 20 ft. 2. In addition, clean-up of track out must be done immediately if it extends 50 linear feet or more onto the paved public road. Otherwise, the track out must be cleaned up by the end of the workday. Clean-up may be performed with a street sweeper or wet broom or by manually sweeping up the deposits.	GRIHA, 2019; AZDOT, 2019; MPCA, 2019	Norm 1 Mandatory	Sediment removal rates can range from less than 30% - 60% for gravel pads and shaker racks.
5	DG sets	1. Ensure DG sets have an exhaust with stack height of at least 2 m from the top of the generator with a cowl. 2. Ensure DGs are in compliance with CPCB norms. 3. Use of Retro-fit Emission Control Devices (RECD) at the stack of DG set like Chakr shield.	GRIHA, 2019; Chakr, 2022	Norms 1 and 2 are mandatory	Chakr shield at the stack of DG set can reduce PM emissions by 70%
6	Mobile emission (Machinery such as breakers, bulldozers, dumpers and excavators, etc.)	1. Regular vehicle maintenance 2. Should comply with the latest norms set by government for construction equipment vehicles (CEV) 3. Reduce idling time- A large diesel engine can waste up to one gallon of fuel for each hour that it idles. In planning day-to-day activities on a construction site, fleet managers can save on fuel costs by taking steps to maximize equipment use and minimize idling time. Equipment operators can help improve the air quality in their work environment by turning off engines when they are not in use.		Norm 2 is mandatory	NA



Control measures for vehicles and machinery at the site

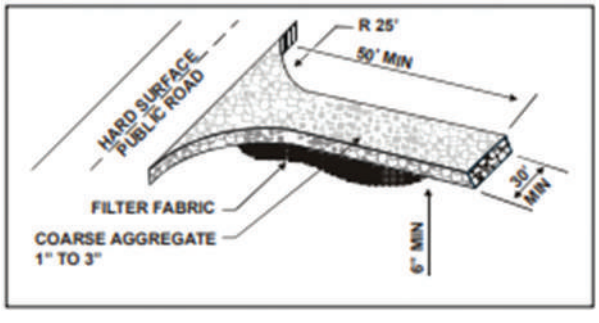


Figure 1: Gravel pad
Source: AZDOT, 2019

Figure 2: Grizzly pad
Source: AZDOT, 2019

Gravel Pad Design: Use one inch (1") to three inches (3") in diameter, washed, well graded gravel or crushed rock. The gravel pad should be at least 30' wide by 50' long, and a minimum of 6" deep. When installing the gravel pad, make sure that it is properly graded.

Table 4: Handling storage and spillage of materials

S.No.	Process	Control measures	Reference	Voluntary/ Mandatory	Efficacy based on Literature
1	Storage of material	1. Guidelines and a step-by-step process for synchronizing the delivery and use of construction materials to minimize the storage period of unused materials (Annexure V). By following these guidelines and steps, construction sites can synchronize the delivery and use of construction materials to minimize the storage period of unused materials, reduce the amount of materials on site, and reduce the potential for air pollution. It is important to note that synchronization of material delivery and use may require careful planning and coordination with suppliers and contractors. 2. Some guidelines and a step-by-step process for covering or sprinkling construction materials with non-potable water to reduce airborne particles are given in Annexure VI. By following these guidelines and steps, construction sites can reduce airborne particles and improve air quality in and around the site. It is important to note that covering or sprinkling materials with water may not be suitable for all materials, so it is recommended to consult with local regulations and any relevant industry standards when developing a dust control plan for a construction site.	CPCB,2016; GRIHA, 2019; CAA, 2021 WRI, 2020	Mandatory	Blue sheet covering- up to 40% Green mesh covering- up to 22% Water sprinkling- up to 65%
2	Transportation of material at and outside the construction site	1. Guidelines and a step-by-step process for implementing the use of closed tankers and sheeted vehicles for transporting construction materials are given Annexure VII.	Kukadia et al., 2003; WRI, 2020	Mandatory	Blue sheet covering- up to 40% Green mesh covering- up to 22%
3	Loading and unloading of materials	1. Drop height must be kept minimum 2. Damp down the dust emissions with water sprinklers	CAA, 2021	Mandatory	NA
4	Storage of cement and other similar material	1. Should be stored in silos having ventilation system fitted with particle filters	Kukadia et al., 2003	Voluntary	NA
5	Use of alternate materials	1. Reuse of C&D waste (fillers in roads and floorings) generated on site. 2. Replacement of Ordinary Portland Cement (OPC) with the Bureau of Indian Standards (BIS) Pozzolanic waste material. 3. Replacement of natural aggregate with recycled concrete aggregate (RCA)/recycled aggregate (RA) by weight of that category of aggregate in structural concrete. 4. Ensure that all internal and external, load-bearing, non-load-bearing and partition walls are constructed with any, or combination of the below listed, alternative materials:	GRIHA, 2019	Voluntary	NA

Table 4: Handling storage and spillage of materials					
S.No.	**Process**	**Control measures**	**Reference**	**Voluntary/ Mandatory**	**Efficacy based on Literature**
		a. Concrete blocks (hollow, solid, or AAC) with fly ash content b. Hollow clay block c. Adobe bricks/stabilized adobe/CSEB/stabilized mud blocks d. Rammed earth walls e. Stones from India (not including stone cladding) f. Bamboo/any other rapidly renewable material (not including bamboo cladding) g. Monolithic concrete wall demonstrating replacement of OPC with BIS recommended waste material h. C&D waste blocks i. Dry walls/boards with recycled content 5. Replacement of OPC with BIS recommended waste used in masonry mortar and plaster.			
6	Storage of chemical	1. Provision of exhaust in the storage room. Steps that can be followed to select low VOC chemicals for a construction site in India are given in Annexure VIII.	GRIHA, 2019	Mandatory	NA
7	Spillage of material	1. Clean the spillage using wet handling methods 2. Implement a spill prevention plan for storage of diesel, admixtures, curing compounds, bitumen, and other hazardous materials.	CAA, 2021	Mandatory	NA
8	Building of stockpile	1. Ensure slopes of stockpiles, tips and mounds are at an angle not greater than the natural angle of repose of the material. 2. Avoid sharp changes of shape. 3. Dusty materials can be damped down using suitable and sufficient water sprays. 4. Stockpile should be covered and covering should be of similar size and height to the stockpile. 5. Long-term stockpiles can be capped or grassed over.	Kukadia et al., 2003; WRI, 2020	Mandatory	Blue sheet covering- up to 40% Green mesh covering- up to 22%

HANDLING STORAGE AND SPILLAGE OF MATERIALS

Storage of materials

- Plan Ahead: Delivery & use of construction materials
- Estimate the required materials.
- Coordinate with suppliers
- Schedule deliveries
- Store Materials appropriately
- Monitor material usage
- Return unused materials
- Maintain Record

Transportation of Materials at & outside the construction site

- Identify materials that require closed tankers
- Identify materials that require sheeted vehicles
- Coordinate with suppliers
- Provide training
- Maintain vehicles
- Monitor material transportation
- Track and report results

Loading and unloading of materials

- Drop height must be kept minimum
- Damp down the dust -emissions with water sprinklers

Storage of cement and other similar materials

- Should be stored in silos having ventilation system fitted with particle filters

Use of alternate materials

- Reuse of C&D waste (fillers in roads and floorings) generated on site
- Replacement of Ordinary Portland Cement (OPC) with the Bureau of Indian Standards (BIS) Pozzolanic waste material
- Replacement of natural aggregate with recycled concrete aggregate (RCA)/recycled aggregate (RA) by weight of that category of aggregate in structural concrete.
- Replacement of OPC with BIS recommended waste used in masonry mortar

Storage of chemicals

- Identify the VOC regulations
- Look for third-party certifications
- Check the product label
- Use water-based products
- Use natural or plant-based products
- Consult with suppliers
- Conduct testing

Spillage of materials

- Clean the spillage using wet handling methods
- Implement a spill prevention plan for storage of diesel, admixtures, curing compounds, bitumen, and other hazardous materials

Table 5: Emissions from other construction activities such as cutting, drilling, grinding, scabbling, sand and grit blasting, and façade cleaning

S.No.	Process	Control measures	Reference	Voluntary/ Mandatory	Efficacy based on Literature
1	Welding and tile cutting	1. Use water sprays to minimize dust from cutting equipment. 2. Employ equipment and techniques that minimize dust emissions, using best available dust suppression measures. 3. By using local exhausting systems for indoor welding and timely checking the working conditions of welders and cutters.	WRI, 2020	1&2 are mandatory	Local exhaust ventilation- up to 92%
2	Sanding	1. Use water spray to minimize dust suspension 2. Use dry wall sanders 3. Worker should wear N99 mask 4. Reduce the exposure by changing shift time to time		Mandatory	
3	Cutting roadways, pavements, blocks, etc.	1. Use a diamond bladed floor saw with water pumped through to suppress dust 2. Standard angle grinders and disk cutters with no dust control should not be used for this purpose.		1.Voluntary 2. Mandatory	

Table 5: Emissions from other construction activities such as cutting, drilling, grinding, scabbling, sand and grit blasting, and façade cleaning

S.No.	Process	Control measures	Reference	Voluntary/ Mandatory	Efficacy based on Literature
4	Raking out mortar/ pointing	1. Standard angle grinders and disk cutters with no dust control should not be used. 2. A mortar raking kit, fitted onto a standard 5' angle grinder can be used on soft mortar. For hard mortar, a super-saw with oscillating blades can be used.		1. Mandatory 2. Voluntary	
5	Scabbling	1. Pre-wash work surfaces. 2. Screen off areas to be scabbled to limit the spread of dust. 3. Vacuum up, rather than sweep away residual dust as this can generate more dust than the scabbling operation itself		Mandatory	
6	Sand, grit or shot blasting and façade cleaning	1. Silica-free material should be used for abrasive cleaning, since the inhalation of silica dust is harmful 2. Wet processes should be used wherever possible. These introduce water into the air/grit stream, greatly reducing the dust hazard 3. Ensure that slurries do not dry out 4. Seal all windows and openings in the structure with polyethylene sheeting		2& 4 are mandatory	

EMISSIONS FROM OTHER CONSTRUCTION ACTIVITIES SUCH AS CUTTING, DRILLING, GRINDING, SCABBLING, SAND AND GRIT BLASTING, AND FAÇADE CLEANING

Welding and tile cutting

- Use water sprays to minimize dust from cutting equipment.
- Employ equipment and techniques that minimize dust emissions, using best available dust. suppression measures.
- By using local exhausting systems for indoor welding and timely checking the working conditions of welders and cutters.

Sanding

- Use water spray to minimize dust suspension
- Use dry wall sanders
- Worker should wear N99 mask
- Reduce the exposure by changing shift time to time

Cutting roadways, pavements, blocks, etc.

- Use a diamond bladed floor saw with water pumped through to suppress dust.
- Standard angle grinders and disk cutters with no dust control should not be used for this purpose.

Raking out mortar/pointing

- Standard angle grinders and disk cutters with no dust control should not be used.
- A mortar raking kit, fitted on to a standard 5' angle grinder can be used on soft mortar. For hard mortar, a super-saw with oscillating blades can be used.

Scabbling

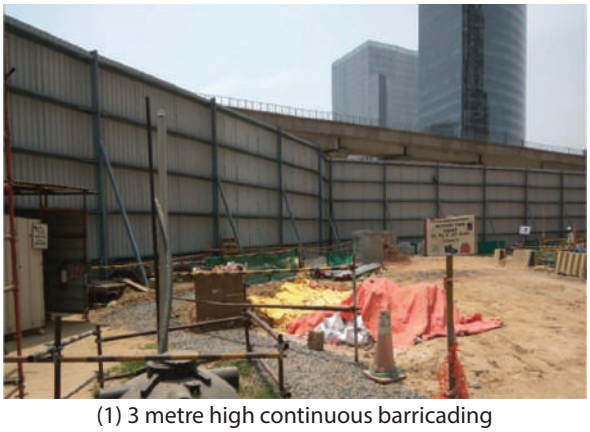
- Pre-wash work surfaces.
- Screen off areas to be scabbled to limit the spread of dust.
- Vacuum up, rather than sweep away residual dust as this can generate more dust than the scabbling operation itself.

Sand, grit or shot blasting and façade cleaning

- Silica-free material should be used for abrasive cleaning, since the inhalation of silica dust is harmful.
- Wet processes should be used wherever possible. These introduce water into the air/grit stream, greatly reducing the dust hazard.
- Ensure that slurries do not dry out.
- Seal all windows and openings in the structure with polyethylene sheeting.

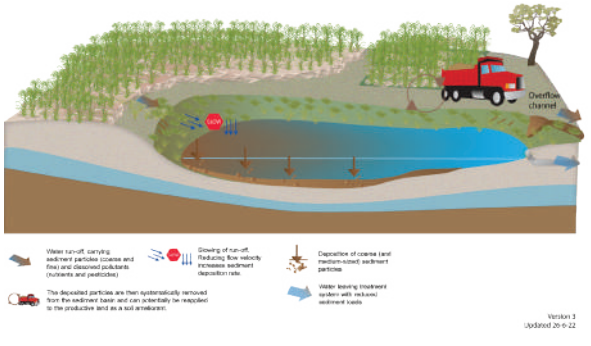
Good construction practices at different sites in India

Land clearing and demolition activities



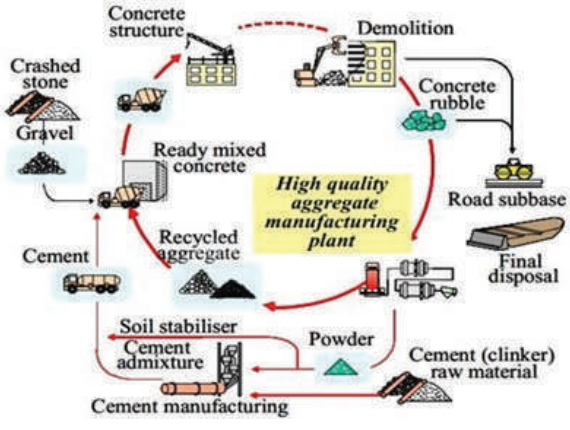
(1) 3 metre high continuous barricading

(2) Wheel washing facility



(3) Construction Phase- Soil erosion channels and sedimentation pits constructed around the sites

(4) Maintenance of top soil- prevention of soil erosion through vegetation-based mulching



(5) Disposal of C&D waste- segregation of construction materials and waste

Control measures for vehicles and machinery at the site

(1) Haul roads and traffic routes- sprinkling water

(2) Site Traffic- speed limit of vehicles on site to 10 km/h

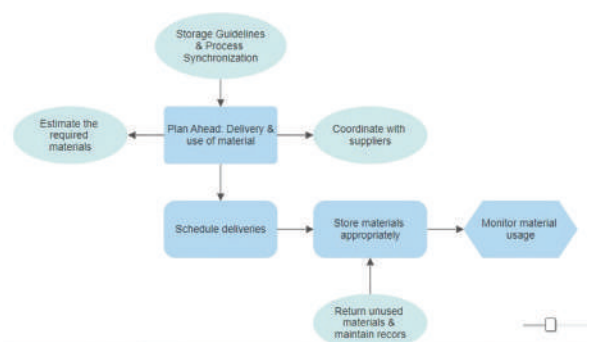
(3) Vehicle waiting area and hard standings- Use of wheel washing and anti-fog guns at construction sites

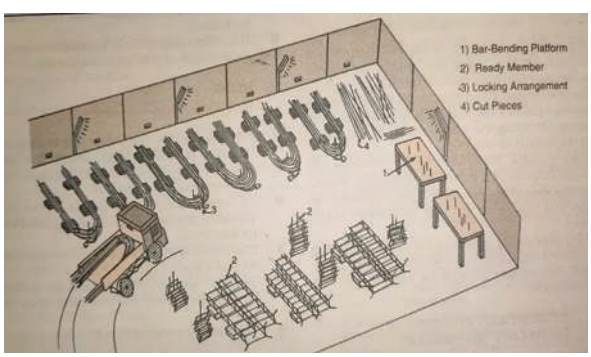
Construction material with a tendency to get airborne are covered

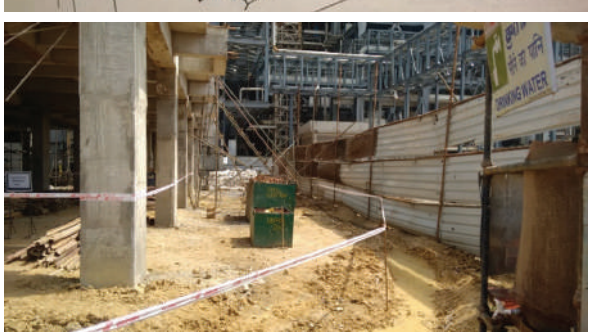
(4) Track out- Paving of track at construction site and clean-up of track out through road sweeper or wet broom or manual sweeping

(5) DG Sets- stack height at least 2 m, use of RECD at the stack of DG set like chakr shield

4) Handling storage and spillage of materials







(1) Storage of material

(2) Transportation of materials at and outside the construction site

(3) Loading and unloading of materials

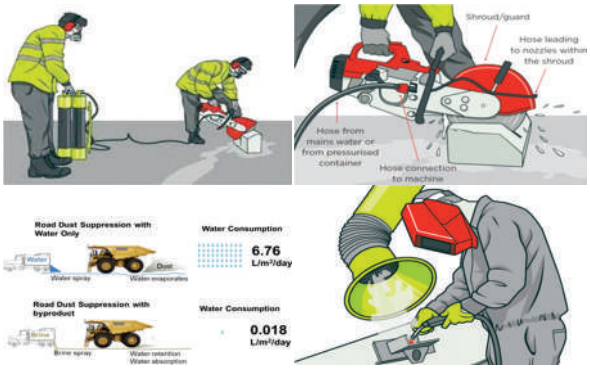
(4) Storage of cement and other similar materials- Should be stored in silos having ventilation system fitted with particle filters

(5) Storage of chemicals particle filters

(6) Spillage of material particle filters

(7) Building of stockpile

Emissions from other construction activities such as cutting, drilling, grinding, scabbling, sand and grit blasting, and façade cleaning



(1) Welding and tile cutting

(2) Sanding

(3) Cutting roadways, pavements, blocks

(4) Scabbling

(5) Sand, grit or shot blasting and façade cleaning

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Annexure I

Construction phase

» ***Site analysis**: First, analyze the site to determine where the sedimentation tank and soil erosion channels should be located. Identify areas that are prone to soil erosion and areas that need to be protected.*

» ***Design**: Once the location is determined, design the sedimentation tank and soil erosion channels. Consider the expected volume of water and sediment, the expected flow rate, and the slope of the land.*

» ***Excavation**: Excavate the area where the sedimentation tank and soil erosion channels will be located. The excavation should be deep enough to accommodate the sedimentation tank and the soil erosion channels.*

» ***Construct the sedimentation tank**: The sedimentation tank should be constructed with concrete or other durable materials. The tank should be designed to slow down the flow of water and allow sediment to settle at the bottom. The tank should also have an inlet and an outlet to allow water to flow in and out.*

Annexure II

Haul roads and traffic routes

a. Bituminous road with plastic waste content
b. Cast in-situ cement concrete road with fly ash content
c. Concrete blocks with fly ash content
d. Paver blocks containing C&D waste content
e. Stones from India
f. Any other product with recycled content

Annexure III

Site traffic: General guidelines for speed limits on construction sites

» *Establishing a maximum speed limit of 5–15 mph for all vehicles on the site, including trucks, construction equipment, and passenger vehicles.*

» *Posting speed limit signs at key locations around the site to remind drivers to slow down.*

Annexure IV

Vehicle waiting area and hard standings: Steps to construct a wheel washing pit

- *Determine the location: Choose a location for the wheel washing pit that is easily accessible for vehicles entering and exiting the site. The pit should be located near the entrance or exit of the site to minimize the amount of dirt and debris that vehicles carry onto the site.*
- *Excavate the pit: Excavate a pit that is large enough to accommodate the largest vehicles that will be using the pit. The depth of the pit will depend on local regulations and site-specific conditions.*
- *Install the washing equipment: Install washing equipment such as a high-pressure water system or spray nozzles. The equipment should be designed to effectively remove dirt and debris from tires and undercarriages.*
- *Stabilized construction entrances such as gravel pad must be installed at all access points if any material is to be hauled on or off the site, or if the site is larger than 5 acres. Design of gravel pad is provided in Figure 1.*
- *Grizzly: A device using rails, pipes or grates to dislodge mud, dirt and debris from the tires and undercarriage of vehicles prior to leaving the work site (Figure 2).*

Annexure V

Handling storage and spillage of materials: Guidelines to minimize the storage period of unused materials:

- *Plan ahead: Plan the delivery and use of construction materials ahead of time to ensure that they are synchronized and that the storage period of unused materials is minimized.*
- *Estimate the required materials: Estimate the amount of construction materials that will be required for the project and plan their delivery accordingly.*
- *Coordinate with suppliers: Coordinate with suppliers to ensure that the materials are delivered on time and in the required quantities.*
- *Schedule deliveries: Schedule deliveries of construction materials so that they coincide with the planned usage of the materials.*
- *Store materials appropriately: Store materials in a suitable location and manner to minimize the storage period of unused materials. This may involve using temporary storage facilities or arranging for the materials to be delivered directly to the point of use.*
- *Monitor material usage: Monitor the usage of construction materials to ensure that they are being used efficiently and effectively.*
- *Return unused materials: Return any unused construction materials to the supplier or arrange for their disposal in a responsible manner to minimize the storage period of unused materials.*
- *Maintain records: Maintain records of material deliveries, usage, and returns to track the progress of the project and ensure that materials are being used efficiently.*

Annexure VI

Handling storage and spillage of materials: Guidelines for covering or sprinkling construction

- *Identify the materials that have a tendency to become airborne: Before starting any construction activity, identify the materials that have a tendency to become airborne. This could include fine aggregate, excavated earth, concrete, and other construction materials.*
- *Plan ahead: Plan ahead to ensure that the materials are covered or sprinkled with water regularly to prevent them from becoming airborne.*
- *Prepare the area: Prepare the area where the materials will be stored or used. This may involve clearing the area of debris and ensuring that there is adequate drainage to prevent standing water.*
- *Cover the materials: Cover the materials with a suitable material such as a tarpaulin, plastic sheeting or other similar covering to prevent them from becoming airborne.*
- *Secure the covers: Ensure that the covers are securely fastened to prevent them from being blown away by the wind.*
- *Sprinkle with water: Regularly sprinkle the covered materials with non-potable water using a water truck or hose. This will help to keep the materials from becoming airborne and reduce the amount of dust and particles in the air.*
- *Monitor the effectiveness: Monitor the effectiveness of the covering or sprinkling of materials to ensure that it is reducing airborne particles effectively.*
- *Maintain the area: Maintain the area by regularly cleaning the covers and ensuring that the materials are covered or sprinkled with water as needed.*

Annexure VII

Transportation of material at and outside the construction site

- *Identify materials that require closed tankers: Identify materials that have a tendency to become airborne, such as powdery substances, and determine if they require transportation in closed tankers.*
- *Identify materials that require sheeted vehicles: Identify other materials, such as loose aggregates, that have a tendency to become airborne during transport and require sheeted vehicles.*
- *Coordinate with suppliers: Coordinate with suppliers to ensure that they are aware of the transportation requirements for the materials they are delivering and that they have access to the appropriate closed tankers or sheeted vehicles.*
- *Provide training: Provide training to drivers and other personnel on the proper handling and use of closed tankers and sheeted vehicles to ensure that they are being used effectively.*
- *Maintain vehicles: Regularly maintain closed tankers and sheeted vehicles to ensure that they are functioning properly and that they are in compliance with all regulations and safety requirements.*
- *Monitor material transportation: Monitor the transportation of construction materials to ensure that closed tankers and sheeted vehicles are being used as required and that materials are not becoming airborne during transport.*
- *Track and report results: Track the use of closed tankers and sheeted vehicles and report on the reduction in airborne particles and other improvements in air quality.*

Annexure VIII

Steps that can be followed to select low VOC chemicals for a construction site in India:

- *Identify the VOC regulations: The first step in selecting low VOC chemicals is to identify the VOC regulations applicable in your region or internationally accepted standards.*
- *Look for third-party certifications: Look for third-party certifications such as Green Seal, EcoLogo, and UL Environment to identify low VOC chemicals. These certifications ensure that the products meet the environmental and performance standards.*
- *Check the product label: Check the product label for VOC content information. Low VOC products usually have VOC content below the regulated limit.*
- *Use water-based products: Water-based products are usually low in VOCs as compared to solvent-based products. Choose water-based additives, curing compounds, and paints instead of solvent-based ones.*
- *Use natural or plant-based products: Consider using natural or plant-based products as they are usually low in VOCs. For example, linseed oil-based paints and soy-based adhesives are low in VOCs and are environmentally friendly.*
- *Consult with suppliers: Consult with your suppliers to identify low VOC chemicals. They can provide information on the VOC content of their products and suggest low VOC alternatives.*
- *Conduct testing: Consider conducting testing to verify the VOC content of the chemicals. Testing can be done by a third-party laboratory to ensure that the chemicals meet the required standards.*

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