FOREWORD

It is rarest for any organization to get a chance to grow for a period of 165 years. From a modest beginning in the year 1854, CPWD is today one of the biggest Central Government Engineering organizations, relentlessly dedicated in the yeoman Service of the Nation and contributing in the infrastructure development which include Roads, Bridges, Buildings, Flyovers, Towns, Sport Stadia, Urban services, Border Roads, Lighting and various E&M services.

CPWD has large bank of Engineering, Architectural and Horticulture human resource, which renders most comprehensive services in the field of planning, designing, construction and maintenance management for all Building & Infrastructure projects with Total Quality Assurance.

As a Principal Technical Advisor to Government of India, CPWD is playing a lead role in the country in dissemination of knowledge relating to practices in building industry for engineering profession. A vast number of technical publications have been brought out by the CPWD for the benefit of engineering community and these are reckoned as standard engineering practices in the public and private sector.

Though CPWD has been planning, designing and constructing the buildings as energy efficient, water efficient and functional suiting to the environment with the concept of sustainable development, this Publication has been brought out for rating of CPWD Buildings for qualifying as “Green”.

I wish to acknowledge the sincere efforts of Smt. Usha Batra, Special Director General (WR) and Dr. K. M. Soni, Additional Director General (TD) and their team of officers for bringing out this useful publication.

(Prabhakar Singh)
PREFACE

CPWD, having the in house expertise in Architectural planning, Civil Engineering, Electrical and Mechanical Engineering and Horticulture has been conceptualizing, constructing and maintaining buildings from smallest size like residential unit to large buildings like institutional buildings, universities and offices.

Keeping in view the initiatives of Government of India for sustainable development, speedy and timely construction, quality and safety, and public welfare measures, CPWD has decided to develop its own green rating manual giving due weightage to sustainability, new technologies, quality and safety, and welfare measures as they affect sustainability.

The manual has been prepared considering green building and sustainability approach and CPWD being a premier construction agency and technical advisor to government of India is committed to enhance quality of life of people by planning and constructing green and sustainable buildings.

I hope that the manual will prove to be very useful and CPWD will be able to rate its buildings to ensure that they perform the function as well as fulfil the aimed purpose of sustainability at national level.

(Usha Batra)

SDG(WR) Mumbai
Sustainable development is the necessity for the very existence of human beings. Buildings consume large resources, both during construction and their operational period. Therefore, sustainable approach must be considered while planning, constructing and maintaining the buildings.

Green building concept is not new now. The concept generally includes energy efficiency, water efficiency and comfort level for the occupants. This is defined through efficient architectural design, sustainable building materials, energy efficient equipments, indoor air quality, water conservation and prevention of wastage. Such concept does not include quality and safety of the structure, green construction processes, timely completion of projects, and welfare measures for common people though important for durability of structures, preventing air pollution, conserving natural resources and for well being of citizens related to sustainable development. Therefore, this manual has been prepared based on green building concept considering sustainable criterion. As the government is committed for improving quality of citizens, policies related to their welfare are also included in the rating system.

Rating is proposed under nine broad criteria such as Architectural Planning and Design, Quality and Safety, Sustainable Building Materials, Green Construction Measures, Water Conservation Measures, Energy Efficiency and Conservation, Waste Management, Welfare Measures, and Landscape and Horticulture.
shall be done considering maximum 100 marks. The buildings/projects are to be rated as Green, Green plus, and Super Green based on the score obtained by them.

Rating criteria include steps to be taken during pre-construction stage, execution and post-construction stage by the architects and engineers involved in various stages hence the evaluation shall be required from the concept stage to completion stage of the buildings.

The Engineer in Charge will be required to register online for the rating. Necessary documentation will also be done by the site engineers either online or physical form. A team of officers drawn from Architects, E&M engineers and Civil engineers will be visiting the site as per the requirements or the instructions issued by the Directorate from time to time. The rating will be awarded once the building is complete, occupied and operational. It is assumed that once the building is planned and executed as green and sustainable, it will remain so during its life cycle to the extent planned. Hence, final rating shall be awarded within 3 months of the occupancy.

In few criteria, a clear cut approach has been given which is just mathematical or pre-determined but all criteria cannot be defined in such a way and also it is not desirable like innovation criterion. Innovation has to be defined by the architects and engineers responsible for planning and executing the work and the team will then assess it, rate it and award the marks.

Marks will not be given in whole numbers and not in decimals. Approval from local bodies like Municipal corporations, fire and environment or as applicable is the prerequisite for award of green rating.

Your suggestions for its improvement will always be welcomed and highly appreciated.

(Dr K M Soni)

ADG(TD)
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The buildings will be rated by a committee of CPWD officers drawn from Architecture, Civil, Electrical and Horticulture cadres. The constitution of the committees for different regions will be decided separately.

Same criteria will be adopted for all types of buildings i.e. residential, office or institutional buildings. The rating will be made for the grades given below;

**Rating Grades**

Rating grades are divided in three groups as given in Table 1. The buildings will be graded as Green, Green Plus and Super Green based on qualifying marks. In case a building scores less than minimum marks required for “Green” certification, no rating will be awarded.

**Table 1: Ratings**

<table>
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<tr>
<th>Certification</th>
<th>Qualifying marks</th>
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<td>Green</td>
<td>55-70</td>
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<td>Green Plus</td>
<td>71-85</td>
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<tr>
<td>Super Green</td>
<td>86-100</td>
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The buildings will be rated under the following criteria as given in Table 2.

**Table 2: The Criteria for Ratings of Buildings**

<table>
<thead>
<tr>
<th>Criterion Subhead</th>
<th>Criterion No.</th>
<th>Criterion name</th>
<th>Weightage</th>
<th>Maximum Points</th>
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<td></td>
<td>1.2</td>
<td>Accessibility in built environment</td>
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<td>2</td>
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<tr>
<td></td>
<td>1.3</td>
<td>Availability of integrated Civil, E&amp;M, and landscape drawings before invitation of bids</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>1.4</td>
<td>Layout/ site planning</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td>New and innovative approach</td>
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<td>2</td>
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<tr>
<td>2. Quality and Safety</td>
<td>2.1</td>
<td>Availability of safety plan before invitation of bids</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2.2</td>
<td>Availability of quality assurance plan before award of work</td>
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<td>4</td>
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<tr>
<td></td>
<td>2.3</td>
<td>Availability of Structural drawings before award of work</td>
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<td>3. Sustainable Building Materials</td>
<td>3.1</td>
<td>Use of flyash based/recycled C&amp;D waste products</td>
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<td>2</td>
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<td></td>
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<td>Use of waste products/alternatives to natural timber in woodwork</td>
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<td>Use of cement manufactured from waste products</td>
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<td>3.4</td>
<td>Use of local materials</td>
<td>2</td>
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<tr>
<td>3.5</td>
<td>Use of recycled materials</td>
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<td>3.6</td>
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<td>3.7</td>
<td>Use of non toxic and non hazardous materials</td>
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<td>6. Energy efficiency and conservation</td>
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<td>Energy efficient building envelope</td>
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<td>6.2</td>
<td>Energy efficient lighting, fans, air conditioners and controls</td>
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In case, any specific criterion is not applicable, the same will not be considered and the marks will be proportioned based on total marks excluding the marks of such criterion/criterion from 100 marks. For example, if after excluding a particular criterion, marks obtained are 65 out of maximum marks 95, the same will be proportioned as $65 \times \frac{100}{95} = 68.42$ rounded off to next full number i.e. 69.

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<td>Reuse of excavated soil</td>
</tr>
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</table>
CRITERION 1: ARCHITECTURAL PLANNING AND DESIGN

Total Marks: 16

Synopsis: Architectural planning and design strategy has to be based on permanent features of sustainable and energy efficiency from life cycle concept simultaneously giving regard to its aesthetics and innovation. For this, passive architecture, landscape minimising hard areas, preserving existing sustainable site features, design according to existing topography and micro climate, and providing adequate shafts for better and effective maintenance are essential along with provisions made in design conforming to accessible norms, integrated services, and innovation.

Compliance Procedure and Award of Marks:
Criterion 1.1: Passive architectural design strategy
Maximum marks – 4
a) Orientation of building and window to wall ratio (WWR) including design of openings / fenestration: 2 points
b) Zoning and massing as per solar path analysis and prevailing wind direction: 1 point
c) Any other climate responsive passive architecture design strategy: 1 point

Criterion 1.2: Accessibility in Built Environment
Maximum marks – 2
a) All the norms of barrier free built environment followed: 2 points
b) More than 60% (physical not to be measured in financial terms) norms followed: 1 point
c) Less than 60% (physical) norms followed: Nil

Criterion 1.3: Availability of integrated Civil, Mechanical Electrical and Plumbing (MEP) Services and landscape drawings before invitation of bids
Maximum marks – 5
a) All drawings available: 5 points
b) Only Building drawings available without services and detailing: 2 points

c) Only architectural drawings available without detailing: 1 point

**Criterion 1.4: Layout/site planning**

**Maximum Marks: 3**

(a) Minimization of roads and hard area (if green area is minimum 60% of plot area minus building footprint area): 1 point

(b) Segregation of pedestrian and vehicular traffic: 1 point

(c) Minimum disturbance to land/site topography: 1 point

**Criterion 1.5: Innovation:**

**Maximum marks – 2**

New & innovative architectural planning and design approach shall be awarded maximum 2 marks. The assessment will be made by the team making the assessment.
CRITERION 2: QUALITY AND SAFETY

Total Marks: 12

Synopsis: Safety and quality are supplementary to each other in construction works and part of sustainability. Safety and quality plans are essential to be prepared before commencement of works so that execution is carried out with safety and quality from day one. Availability of structural designs is also essential before award of work so that they are adequately correlated with architectural drawings and green concept is implementable from architectural and structural considerations.

Compliance Procedure and Award of Marks:

Criterion no. 2.1: Quality Assurance

Maximum Marks: 4

1. (a) Quality assurance plans available before commencement of work: 2 points
   (b) Available after commencement of work: 1 point
   (c) Quality assurance plan not prepared: Nil

2. (a) 100% execution/implementation of quality assurance plan as prepared in 1 (a) above: 2 points
   (b) Part implementation or no implementation of quality assurance plan: Nil

Criterion no. 2.2: Safety Assurance

Maximum Marks: 4

1. (a) Safety assurance plan available before commencement of work: 2 points
   (b) Available or made available after commencement of work: 1 point
   (c) Safety assurance plan not prepared: Nil

2. (a) Implementation of safety plan as per the policy of the Department: 2 points
   (b) Part implementation of safety plan or not being implemented: Nil
Criterion no. 2.3: Structural Drawings for Structural Safety Assurance

Maximum Marks: 4

3. (a) All structural designs and drawings available before commencement of work in EPC contracts and before award of work in other contracts: 4 points

(b) Partly available but available before commencement of activities but no hindrance leading to delay in completion of work: 2

(c) Hindrance due to structural drawings leading to delay in completion of work: Nil
CRITERION 3: SUSTAINABLE BUILDING MATERIALS

Total Marks: 16

Synopsis: Waste has to be converted into resource and to be used as building materials ensuring quality and sustainability. Therefore, use of materials manufactured from waste is considered in this criterion.

Apart from this, use of local materials provides employment opportunity to local people and also contributes to green concept due to less transportation involved. Therefore use of local materials is also included in this criterion. Use of “Make in India” products and non toxic and non hazardous materials is also included.

Compliance Procedure and Award of Marks:

Criterion no. 3.1: Use of Recycled Waste Products in Masonry Work

Maximum Marks: 2

1. (a) Use of flyash bricks/AAC blocks or recycled C&D waste blocks in full brick/block masonry: 2 points
   (b) In case more than half brick/block masonry work but not full with flyash bricks/AAC blocks/recycled C&D waste blocks = 1 point
   (c) If no fly ash bricks/AAC blocks/recycled C&D waste blocks used in masonry works = Nil

Criterion no. 3.2: Use of Waste Products/alternatives to natural Timber in Wood Work

Maximum Marks: 2

1. (a) Use of alternate materials of natural timber in full wood work: 2 points
   (b) If more than half alternate materials used in woodwork = 1
   (c) If no alternate material used in wood work = Nil

Criterion no. 3.3: Use of Cement Manufactured from Waste Products

Maximum Marks: 2

1. (a) Use of flyash in 100% cement concrete with OPC or PPC in cement concrete and
 PPC/blended cements in all other works: 2 points

(b) Use of flyash in 50 to 100% in cement concrete with OPC or 50 to 100% PPC/blended cements in cement concrete and in all other works: 1 point

(c) Use of flyash/PPC/blended cements less than mentioned in (b) above: Nil

**Criterion 3.4: Use of Local Materials**

**Maximum Marks: 2**

1. (a) Use of local material/items (Available within 100 kms) to the extent of minimum 5% or more of the cost of construction: 2 points

   (b) Use of local material/items (Available within 100 kms) to the extent of minimum 2 to 5% of the cost of construction: 1 point

   (c) Use of local material/items (Available within 100 kms) less than 2%: Nil

**Criterion no. 3.5: Use of Recycled Materials**

**Maximum Marks: 3**

1. (a) Use of recycled sand, aggregates or manufactured sand: Minimum 25% of the total quantity used: 1 point

   (b) Use of recycled sand, aggregates or manufactured sand: Less than 25% of the total quantity used: Nil

2. (a) Use of recycled materials in flooring and false ceiling: 1 point

   (b) Use of recycled materials in landscape/art works: 1 point

**Criterion no. 3.6: Adherence to Make in India Policy for Civil, E&M and all other products**

**Maximum Marks: 2**

1. (a) Full adherence to Make in India policy: 2 Points

   (b) Non adherence fully: Nil
Criterion no. 3.7: Use of Non Toxic and Non Hazardous Materials

Maximum Marks: 3

1) (a) Use of low VOC primer and paint (less than 50 grams/litre) in 100% applications: 2 points
   (b) Use of primer and paint having VOC 50 grams/litre or more: Nil

2) (a) Following hazardous waste management Rules/policy during construction and operation: 1 point
   (b) Not following (a) above: Nil
CRITERION 4: GREEN CONSTRUCTION MEASURES

Total Marks: 14

Synopsis: Building construction involves large numbers of methods, equipments and technologies to be adopted during construction. These are to be environmental friendly to avoid pollution and wastage to make construction “Green”.

These green construction measures are required during storage and placement of materials, installation of equipments and carrying out during execution of work.

Compliance Procedure and Award of Marks:

Criterion No.4.1: Air Pollution and Noise Control Measures

Maximum Marks: 2

1. (a) Use of air pollution control measures like washing tyres of material carrying vehicles, sprinkling of water and other measures to reduce air pollution: 1 point
   (b) Not abiding condition (a) above: Nil

2. (a) Use of barricading minimum of 3 m height and as per the norms of the local body: 1 point
   (b) Not abiding condition (a) above: Nil

Criterion No.4.2: Trenches for Integrated Services

Maximum Points: 2

a) Construction of trenches for integrated utility services like fire, water supply, air conditioning, telephones, electric cabling etc.: 2 points

(b) Construction of trenches for part utility services: 1 point

(c) No construction of trenches for services: Nil
Criterion No.4.3: New Construction Technologies for Green Construction

**Maximum Points: 3**

(a) Adoption of green construction technologies for building/roadwork, flooring, plastering, tile work, laying utility services (trenchless technologies) or other construction works: 3 points

(b) If adopted partly: 1 point

(c) If not adopted: Nil

**Criterion No.4.4: Use of Equipment/techniques to avoid Generation of C&D wastage**

**Maximum Points: 3**

(a) Use of small equipments to make chases and avoiding breakage by chiselling or making arrangements of “no cutting” for water supply lines in the walls: 1 point

(b) Use of small equipments to make chases or making arrangements of “no cutting” for laying electrical conduits and avoiding chiselling in the walls: 1 point

(c) Use of small equipments to drill holes and avoiding chiselling/hammering or making arrangements of “no cutting” in walls to take out services: 1 point

**Criterion no. 4.5: New Construction Technologies for Speedy Construction**

**Maximum Points: 4**

(a) Completion of work as per scheduled period mentioned in Preliminary Estimate: 2 points

(b) Before 1/16th period = 3 points

© Before 1/8th period = 4 points
CRITERION 5: WATER CONSERVATION MEASURES

Total Marks: 7

Synopsis: Use of water efficient fixtures, rain water harvesting, recycling of waste water and conservation of treated water need to be adopted in building construction and operation during its life cycle hence this criterion.

Compliance Procedure and Award of Marks:

Criterion 5.1: Recycling water

Maximum Marks: 3

(a) Recycling to the extent of 80% water or above = 3 points
(b) Recycling to the extent of 50-80% water = 2 points
(c) Recycling to the extent of 20-50% water = 1 point
(d) Recycling less than 20% = Nil

Criterion 5.2: Rain Water Harvesting

Maximum Marks: 2

(a) Use of rain water harvesting to the extent of 50% of the rainfall on the rooftop of the building (s) = 2 points
(b) Use of rain water harvesting to the extent of 20 to 50% of the rainfall on the rooftop of the building (s)= 1 point
(c) Use of rain water harvesting to the extent of less than 20% of the rainfall on the rooftop of the building (s) = Nil

Criterion 5.3: Use of Water Efficient Fixtures

Maximum Marks: 2

(a) Use of low flow water supply fixtures = 1 point
(b) Use of low flow/waterless flushing fixtures/urinals = 1 point
CRITERION 6: ENERGY EFFICIENCY MEASURES

Total Marks: 22

Synopsis: Energy required in a building is very high both during its construction and its life cycle. Comfort level and indoor air quality are also related to energy requirements of the buildings hence energy efficiency through conservation and on site generation are very essential for reduction of carbon emissions.

Compliance Procedure and Award of Marks:

In case a building is designed and constructed as net zero/100% onsite energy producing building, full 16 marks will be awarded to such building without any further analysis in this criterion. In case, net plus (to the extent of 20% or more) onsite energy efficient building is constructed, additional 4 points will be awarded (Total 26 points) and for other conditions, procedure mentioned below is be adopted.

Criterion No.6.1: Energy Efficient Building Envelope

Maximum Marks: 4

(a) Super ECBC compliant = 4 points
(b) ECBC+ compliant = 3 points
(c) ECBC compliant = 2 points

Criterion 6.2: Energy Efficient Lighting, Fans, Air conditioners with Controls

Maximum Marks: 4

1. (a) Use of 100% LED lights (indoor and outdoor) = 2 points
   (b) Use of 75 to 100% LED lights = 1 point
   (c) Use of less than 75% LED lights = Nil

2. (a) Use of all energy efficient 5 star - fans and unitary ACs = 2 points
   (b) use of 75-100% energy efficient 5 star - fans and unitary ACs = 1 point
In case of HVAC/VRV system;

(a) Energy efficient, 5 star fans and unitary ACs (if provided) and for HVAC/VRV system, minimum coefficient of performance (COP) and integrated part load value (IPLV) as per ECBC norms: 2 points

(b) Only energy efficient HVAC/VRV system as above but not fans and unitary ACs as per (a) above: 1 point

**Criterion 6.3: Energy efficient Pumps, Lifts and other Equipments**

**Maximum Marks: 2 point**

1. (a) Providing energy efficient pumps and DG set: 1 point

2. (a) Providing energy efficient/regenerative lifts: 1 point

**Criterion 6.4: Integration of controls with IBMS and sensors for lighting fixtures**

**Maximum Marks: 3**

(a) Providing Integrated building management system (IBMS): 2 points

(b) Providing sensors for lighting fixtures: 1 point

**Criterion 6.5: Generation of Renewable Energy**

**Maximum Marks: 8**

On site solar power or other non conventional power generation:

1. (a) 10% generation of required power for operation of the building/equipment provided in the building = 2 points

(b) 100% generation of required power for operation of building/equipment provided in the building i.e. net zero or positive energy building = 8 points

(c) For other conditions marks will be given on pro-rata basis between 2 and 8.

**Criterion 6.6: Innovation in Energy Efficiency: 1 Point**

The assessment of innovation measures considered in energy efficiency will be made by the team making the assessment.
CRITERION 7: WASTE MANAGEMENT

Total Marks: 4

Synopsis: Waste has to be managed during construction, and after occupancy of the building for hygiene, human comfort, welfare, energy efficiency and sustainability.

Compliance Procedure and Award of Marks:

Criterion 7.1: Waste Management Policy

Maximum Mark: 1

(a) Availability of waste management plan conforming to Solid Waste Management (SWM) Rules/policy before award of work: 1 point

(b) If not available: Nil

Criterion 7.2: Organic Waste Converter/Compost pits

Maximum Marks: 2

(a) Providing organic waste converter: 2 points

(b) Providing compost pit: 1 point

(c) None of above: Nil

Criterion 7.3: Waste segregation

Maximum Mark: 1

(a) Providing segregation facilities for C&D waste, wet waste and dry waste = 1 point

(b) If not provided: Nil
CRITERION 8: WELFARE MEASURES

Total Marks: 4

Synopsis: The objective of green building and sustainability is to improve the quality of life of present and future generations. Welfare measures of workers, engineers and other personnel working at construction site therefore become part of green building concept.

Compliance Procedure and Award of Marks:

Criterion 8.1: Toilet Facilities during Construction

Maximum Marks: 2

1. (a) Toilets for workers and staff as per norms at site with signage = 1 point

2. (a) Separate toilet facilities for ladies (workers and staff) as per norms at site with signage = 1 point

Criterion 8.2: Welfare Measures during Construction

Maximum Marks: 2

1. (a) Welfare measures for workers, staff and their children like shelter, canteen, crèches etc with proper signage= 1 point

2. (a) Construction of office, conference room and display arrangements for architects, engineers and other staff with signage = 1 point
CRITERION 9: LANDSCAPE AND HORTICULTURE

Total Marks: 5

Synopsis: Proper landscape and horticulture helps in environmental protection, bringing down the surrounding temperature around building leading to reduction in energy requirements during summer, reduction in air pollution, ground water recharging and in improving indoor air quality.

Compliance Procedure and Award of Marks:

Criterion 9.1: Trees Protection and Transplantation

Maximum Marks: 3

(a) No cutting (felling) of trees due to planning and construction of building(s) avoiding cutting of trees = 3 points

(b) 80-100% transplantation of existing trees = 2 points

(c) 60% transplantation of existing trees and plantation of trees in lieu of trees cut as per local bye-laws subject to minimum 5% of native species = 1 point

Criterion 9.2: Irrigation System

Maximum Mark: 1

(a) Efficient irrigation system like micro, drip or sprinkler irrigation = 1 point

(b) Not as per (a) above: Nil

Criterion 9.3: Reuse of Excavated Soil

Maximum Mark: 1

(a) 100% reuse of excavated soil at the site: 1 point

(b) Not as per (a) above: Nil
DEVELOPED BY

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