Feasibility Study of DSMax Administrative Block for LEED India Rating System

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***Abstract*- Green building defines as the practice of creating structures and using processes that are environmentally responsible and resource efficient throughout a building's life cycle from site selection to design, construction, operation, maintenance, renovation and deconstruction. Green building is becoming more and more popular because they are considered as environment friendly building. Different rating systems are used for rating the green buildings. India has three systems of green homes ratings, they are 1) GRIHA (Green Rating for Integrated Habitat Assessment), 2) IGBC- Indian Green Building Council (LEED) and 3) BEE (Bureau of Energy Efficiency). Every time new construction of buildings are focused and studied to achieve the required points of sustainable habitats. But there is lots of building which are actually constructed without considering the green building concept. So with the help of LEED India rating system, existing building is focused and studied to reduce primary energy and water demands. We can increase the potential of resource efficiency in existing buildings to reduce consumption, optimize operational and maintenance cost and by adding more of indoor comforts to the occupants. This would help the existing building in rising towards higher levels of sustainability and get rated by LEED India rating system.**

INTRODUCTION

Members of the society live in a modern way and largely urban world consuming more energy and resources than it is possible to fill up again. Historically, man's need for technological and financial advancement has resulted in environmental humiliation. Today, enlarging global population, urbanization, rising income level and resultant increase in the action of using up a resource are adding a lot of pressure on precious natural resources.. Sustainability and renewable development concentrate more on modify the prime line between our competing required, our demand to pass further technologically and economically, and the need in order to preserve the environment in which we live.

"A green building is one which utilize a smaller amount of water, optimizes vitality order, preserves natural resources, cause not so much waste and supply healthier room for residents, as compared in order to a standard building."

LEED Green Building Rating System: In the early 21st century the Confederation of Indian Industry (CII) adopted the green building movement. The Council which actively promotes and pioneers green building strategies in India was formed in 2001 and hence called the Indian Green building council (IGBC). An internationally renowned benchmark for the design, construction and operation of high-performance green buildings is the LEED rating system. By sustainability and standardizing performance metrics it fosters the whole building approach in the following areas: Sustainable sites, Water efficiency, Energy and Atmosphere, Conservation of materials and resources, Indoor environmental quality, Innovation & Design Process

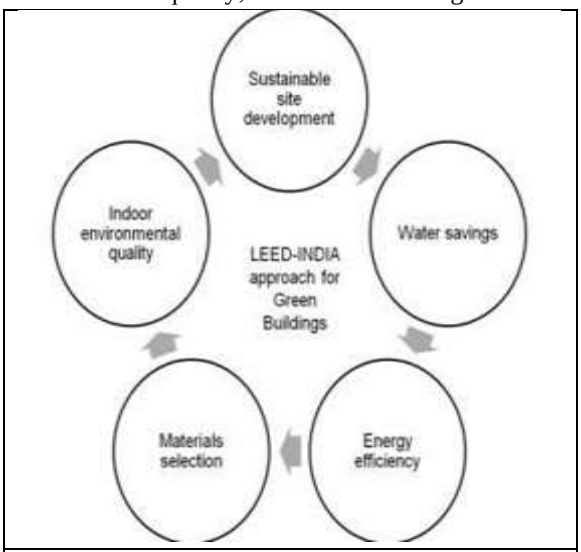


Fig. 1.1 Five environmental categories of LEED

In 2003 LEED India was launched and has been growing rapidly ever since. This has created a large amount of smaller shareholders that increases the construction industry, corporate

enterprise, governmental agencies, architects, developers, builders and product manufacturers. Most fascinatingly, this junction also includes green building consultants — an occupation almost unknown of, a decade ago.

FEATURES OF LEED INDIA

The LEED India Green Building Rating System are voluntary, agreement– based, Market-driven building rating system based on the preset proven technology. It evaluates environmental performance from a whole building view over a building's life cycle, providing a conclusive standard for what compose a "green building". The rating system has been organized into five environmental categories: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources and Indoor Environmental Quality. An additional category, that is Innovation & Design Process, under the five environmental classification.

Scope/Objective: The objective of this thesis is to rate an existed building and to know its sustainability. This is analysis done to an existed building which satisfies the LEED India rating system for all the categories mention below and to check whether the mandatory point which is mentioned in the LEED checklist satisfies. The human race is expanding faster than the planet can sustain. Such an unsustainable pattern of growth clearly leads to environmental harm that must be reversed or slow downed. Therefore green rating system like LEED can help to reduce and also to improve occupant life (health) or whoever may be living at that place plus also the environment in a better way.

Methodology: There are different rating systems in India but I have taken LEED rating system for rating an existed building. In this I have rated the building according to the guideline or checklist, which has been provided by the LEED itself. According to that the points have been given to the building.

LITERATURE SURVEY

Different rating systems are used for rating the green buildings. India has three systems of green homes ratings, they are 1) GRIHA (Green Rating for Integrated Habitat Assessment), 2) IGBC- Indian Green Building Council (LEED) and 3) BEE (Bureau of Energy Efficiency). Every time new construction of buildings are focused and studied to achieve the required points of sustainable habitats. But there is lots of building which are actually constructed without considering the green building concept. So with the help of LEED India rating system, existing building is focused and studied to reduce primary energy and water demands. We can increase the potential of resource efficiency in existing buildings to reduce consumption, optimize operational and maintenance cost and by adding more of indoor comforts to the occupants. This would help the existing building in rising towards higher levels of sustainability and get rated by LEED India rating system or other ratings of India. For this I have seen many articles and paper to get more information regarding this, yourarticlelibrary.com/essay/essay-on-green-building-movement-in-india, proposal of a methodology for achieving a LEED O+M certification, Facilitating Green Building Adoption - An Optimization Based Decision Support Tool Debjyoti Roychowdhury.

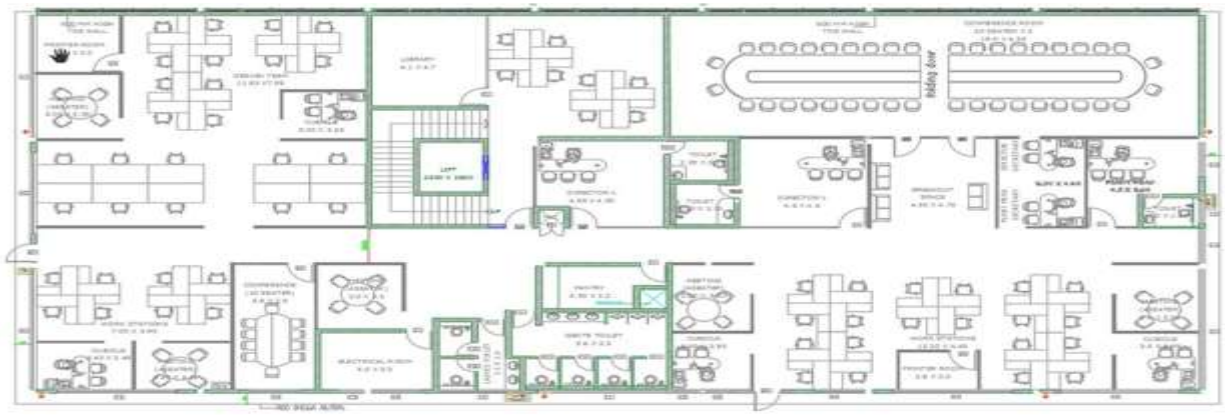
CASE STUDY

DS-MAX PROPERTIES Pvt. Ltd. is a real estate and construction company in Bangalore with core competence in highly accessible locations in Bangalore and timely completion of projects. DS-MAX has now constructed a new administration block. It is done as per LEED India under New Construction V1.0 rating system guidelines. The DS-MAX admin building consists of the following spaces, Office Cabins for its staff members; Work stations, Conference hall. Project details: Name – Administration Block, DS-MAX, Location – Bengaluru, Karnataka, Built up area -1487.98 Sq.m, Building Footprint – 888 Sq.m, Conditioned Area-1285.49 Sq.m, Landscape Area – 3223 Sq.m. No of floors – 2, No of working days – 260 days, No of Parking Spaces - 13 Nos

Occupancy Schedule : Office Staff – 125 nos , Maintenance Staff – 5 nos , Visitors – 13 nos

THIRD FLOOR PLAN

Fig. 3.1 Floor plan of DS Max building



FOURTH FLOOR PLAN

Fig. 3.2 Floor plan of DS Max building

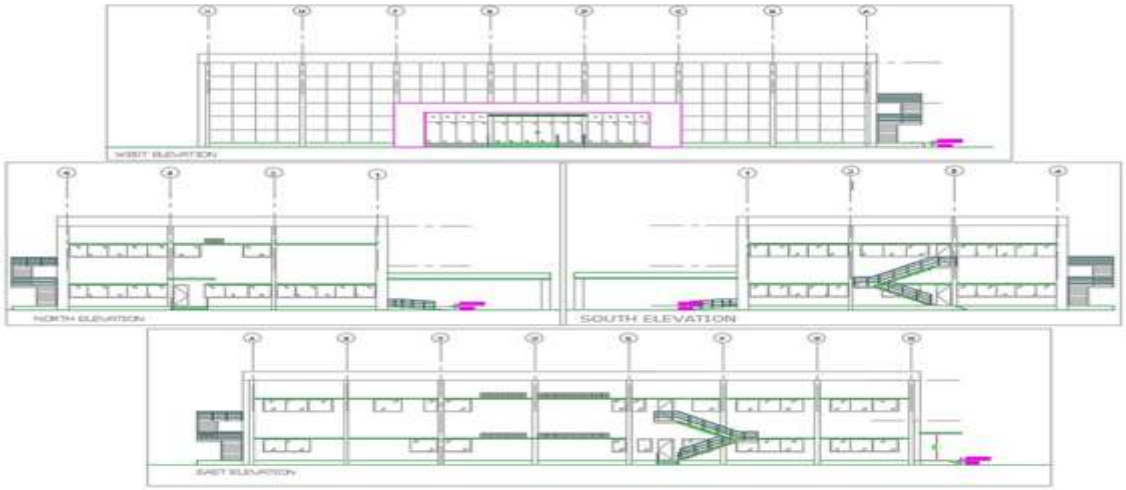


Fig. 3.3 Elevation plan of DS Max building

SUSTAINABLE SITES (MAX 13 POINTS):

PREREQUUISITE 1	EROSION & SEDIMENTATION CONTROL	REQUIRED	POINTS
CDT 1	Site Selection	1	1
CDT 2	Development Density & Community Connectivity	1	0
CDT 3	Brownfield Redevelopment	1	0
CDT 4.1	Alternative Transportation, Public Transportation Access	1	1
CDT 4.2	Alternative Transportation, Low Emission & Alternative Fuel Refueling Stations	1	1
CDT 4.3	Alternative Transportation, Parking Capacity	1	1
CDT 5.1	Reduce Site Disturbance, Protect or Restore Habitat	1	1
CDT 5.2	Reduce Site Disturbance, Development Footprint	1	1
CDT 6.1	Stormwater Design, Quantity Control	1	0
CDT 6.2	Stormwater Design, Quality Control	1	1
CDT 7.1	Heat islands Effect, nonroof	1	1
CDT 7.2	Heat Islands Effect, roof	1	1
CDT 8	Light Pollution Reduction	1	0

Table 4.A.1 Sustainable Sites CDT Points

Prerequisite 1 – Erosion & Sedimentation Control, Intent: To control or reduce erosion and negative impacts on water and air quality. Requirements: It should meet the following objectives: A site sediment and erosion control plan should be design; it should be highlighted by the National Building Code of India (NBC) Part 10, section 1, chapter 4 – Protection of Landscape during Construction. • Prevent loss of soil during construction by storm water run-off or wind erosion. • Prevent sedimentation of storm sewer or receiving streams or air pollution with dust and particulate matter. Approaches, Goal, Minimize Erosion, Detain Excess Storm Water runoff, Prevent Offsite Sedimentation. Site Specific Condition: The site was not previously developed & the soil was not disturbed before the construction process so is it used for landscaping.

During Construction Measures: Watering the site to harden the loose soil, Temporary sedimentation basin with screen filter at the lowest point, where storm water goes out of the site - to remove TSS & sediments from the storm runoff

Fig. 4.A.11 Landscape of DS Max Building

Site Selection: Intent: Reduce the environmental impact from the location of a building on a site and it should not be inappropriate sites. Requirements: Site should be anything but a prime farm land. Site which existing to acquisition for the project should not be in public parkland. A site should be not in danger of biodiversity degradation, Elevation of the land shall be taken into care. Approaches: The DS-MAX building is constructed with the required and regulatory codes thus meeting the intent of the CDT.

Alternative Transportation, Public Transportation Access: Intent: To reduce pollution and land development impacts from vehicles use. Requirements: It should be within 0.8 km of a commuter rail, light rail or subway station or 0.4 km of two or more public or campus bus lines usable by building occupants. Approaches: DS-MAX is constructed on a previously developed site & the projects have bus lines within 0.4 Km from its entrance and also have shuttle services.

Fig. 4.A.13 Site Plan

Fig. 4.A.12 Public Transportation Access

Alternative Transportation, Low Emission & Alternative Fuel Refueling Stations: Intent: To reduce pollution and land development impacts from vehicles use. Requirements: Fuel pumps shall be provided for the area in 3% of total of capacity of vehicles and versatility of the source should be taken into care. Approaches: DS-MAX has provided 13 Nos of Car parks inside its premises.

Alternative fuel refilling stations Requirement:. Four Wheeler: 3% of 13 Nos of parking spaces- 0.23, i.e., 1 No of Electrical Charging Point. DS-MAX has provided a total of 1 Nos of electrical charging points.

Alternative Transportation, Parking Capacity, Intent: To reduce pollution and land development impacts from vehicles use.

Requirements: Public transport and sharing basis 5% of the total provided Parking spaces. Approaches:DS-MAX has provided 13 Nos of Car parks inside its premises.

Parking Capacity Requirement as per local by law: Parking Spaces provided: 13 Nos.

Justification: Preferred Parking space requirements:

Design of Strom water Control, Intent: Removing storm water runoff, Increasing on-site infiltration, Eliminating contaminants, Requirements are Site storm water treatment systems, To remove the total suspended solids from all storms.

Approaches: Design strategy Rain water harvesting pond is provided with a screen filter to remove TSS entering the pond. Measure considered for removal of Total suspended solids from Storm water is follows:

- During construction: The rain water harvesting pond has been designed and installed such that the detention period will be adequate for the TSS to settle at the bottom.
- Post construction: Landscaping areas post construction will also retain the suspended solids from storm water runoff.
- Storm water collection pond has been provided in order to collect the storm water inside the site.
- Rain water harvesting pond is provided with silt trap at the outlet of storm water channel
- Periodical cleaning process will be carried out to improve the TSS removal efficiency for both the rain water harvesting pond.

Heat Island Effect, Non-Roof:

Intent: To minimize impact on microclimate and human and wildlife environment and also to reduce heat islands.

Requirements: 50% of parking spaces in the basement.

Approaches:

Total Car Parking Capacity	- 13 Nos
Area of 1 Car Park	- 15 Sqm
Total car Parking Area	- 195 Sqm
Ground level (Surface parking)	- 13 Nos
Parking area with cover	- 195 Sqm

Percentage of car park 0under structured parking is 100% which is more than the CDT requirement of 50%.

Heat Island Effect, Roof:

Intent: To minimize impact on microclimate and human and wildlife environment and also to reduce heat islands. Requirements: Use Solar Reflectance Index roofing materials.

Approaches: The project team has painted all its exposed roof of the building with High SRI Paint in order to reduce the effect of Heat Island.

Measurement & Verification: Intent To calculate Energy performance of the structure. Requirements: Install or Measurement has to be verified. Approaches: DS Max has installed energy auditing system. Green Power- Intent: Encourage investments in off-site renewable energy technologies to be exported to the grid. Requirements are The source of energy with respect to operation of the house shall be renewable and green. Approaches: Declaration on Green Power for the Annual Energy Consumption will be done by the company.

Base case					
Flush fixture	Daily uses	Flow rate LPF	Duration Flush	Occupant users	Sewage generation
Conventional Water closet					
Male	1	6	1	67	402
Female	1	6	1	67	402
Ultra low flow water closet half flush					
Male	0	6	1	67	0
Female	2	6	1	67	804
Urinal					
Male	2	3.78	1	67	506.52
Female	0	3.78	1	67	0

Flow fixture	Daily uses	Flow rate LPM	Duration Sec	Occupant users	Sewage generation
Public lavatory faucet	3	9.5	15	134	954.75
Health faucet	1	9.5	15	134	318.25
Total daily volume					3387.52
Annual working days					260
Annual volume (lit/yr)					**8,80,755**

S.NO.	TITLE	REQUIRED	POINTS
Prerequisite 1	Fundamental Building Systems Commissioning	Required	Mandatory
Prerequisite 2	Minimum Energy Performance	Required	Mandatory
Prerequisite 3	Fundamental Refrigerant Management	Required	Mandatory
CDT 1	Optimize Energy Performance	10	2
CDT 2	Onsite Renewal Energy, 2.5%, 5%, 7.5%	3	0
CDT 3	Additional Commissioning	1	1
CDT 4	Ozone Depletion	1	1
CDT 5	Measurement & Verification	1	1
CDT 6	Green Power, 50%	1	1
Total		17	6

Table 5.A Energy and Atmosphere CDT points

S.NO.	TITLE	REQUIRED	POINTS
Prerequisite 1	Storage and Collection of Recyclables	Required	Required
CDT 1.1	Building Reuse, Maintain 75% of Existing Walls, Floors and Roof	1	0
CDT 1.2	Building Reuse, Maintain 100% of Existing Walls, Floors and Roof	1	0
CDT 1.3	Building Reuse, MAINTAIN 100% Shell + 50% Non Shell	1	0
CDT 2.1	Construction Waste Management, Divert 50% from Disposal	1	1
CDT 2.2	Construction Waste Management, Divert 75% from Disposal	1	1
CDT 3.1	Resource Reuse, 5%	1	0
CDT 3.2	Resource Reuse, 10%	1	0
CDT 4.1	Recycled Content, 5%	1	1
CDT 4.2	Recycled Content, 10%	1	1
CDT 5.1	Regional Materials, 20%	1	1
CDT 5.2	Regional Materials, 50%	1	1
CDT 6	Rapidly Renewable Materials, 5% of Building Materials	1	0
CDT 7	Certified Wood, 50% of Wood based Materials	1	1
Total		13	7

Table 5.B.1 Materials and Resources CDT points

Prerequisite 1 - Storage & Collection of Recyclables: Intent: The depletion of waste produced by building occupants that is pull or drag to and disposed of in landfills. Requirements: The entire building must serves an easy accessible and is dedicated to the separation, collection and storage of materials for recycling.

Approaches: Waste Handling & Disposal – Procedure & Strategies: Common waste collection facility with separate waste bins are provided for the Collection &

Segregation of the following anticipated non-process waste types: Paper, Plastic, Metal, Cardboard , Glass,

Construction waste management, Divert 50% from Disposal & CDT 2.2 - Construction waste management, Divert 75% from Disposal: Intent: Draw apart construction, demolition, and land clearing waste from the landfill disposal, and also deflect recyclable recovered resources back to the manufacturing process.

Requirements: Recycle 75% of construction, demolition, and land clearing waste. Approaches: The project team has diverted 77.2% of the waste generated from the construction which being sent to landfill. The project team, comprising of contractors, project management, architects & clients has been briefed about the construction waste management. In this project during construction, the CWM plan was designed and in place to segregate & store the construction waste generated, during the whole construction process. The plan includes the following:

Recyclable materials such as steel, Cement bags, Aluminum & Packaging have been sent for recycling. The following materials has produced only negligible waste at site and the same has been taken back by contractor Glass, ACP, Paint cans. With all the above mentioned strategies, project was able to divert 77.2% of the construction waste from landfill.

S No Material/Product Recycled content (PC+(1/2)PI) Vendor Name

1. Steel 25% Default Content
2. Aluminum 20% Jindal
3. Glass 25% Glascon
4. AAC Blocks 65% Popular
5. Ceiling tiles 46% Armstrong
6. Furniture 49.60% Featherlite

Recycled Content, 5% & CDT 4.2 – Recycled Content 10%:Intent:

Increase demand for structure products that include recycled content materials, therefore lowering impacts resulting from extraction and making of new unused materials. Requirements are Use materials with recycled content at least 15%. Approaches-The total recycled content in the materials constitutes of 12.78 % of the total cost of the materials used in the project.

Table.5.B.3 Recycled Content Products

S No	Material/Product	Recycled content (PC+(1/2)PI)	Vendor Name

1	Steel	25%	Default Content
2	Aluminum	20%	Jindal
3	Glass	25%	Glascon
4	AAC Blocks	65%	Popular
5	Ceiling tiles	46%	Armstrong
6	Furniture	49.60%	Featherlite

Regional Materials, 20%: Intent: To support the local economy and to reduce the environmental impacts resulting from transportation and also increase the demand for building materials and products that are extracted and produced within the region. Requirements: In the Vicinity of at least 800 m, 20% of the material is supposed to be provided from. Approaches: Approximately 42.75% of total factory building materials by cost used in this project are manufactured within the same distance as above.

S No	Material/ Product	Manufacturing distance
1	RMC	20
2	Cement	200
3	Glass	100
4	AAC Blocks	80
5	Granite	15
6	Aluminium	450

Table.5.B.4Manufacturing Distance of Products

Regional Materials, 50%:
Intent: To support the local economy and to reduce the environmental impacts resulting from transportation and also increase the demand for building materials and products that are extracted and produced within the region.

Requirements: In the Vicinity of at least 800 m, 50% of the material is supposed to be provided from. Approaches: Approximately 50% of total factory building materials by cost used in this project are extracted harvested within 800 Kms.

S No	Material/Product	% of materials extracted
1	RMC	100
2	Cement	100
3	Glass	100
4	AAC Blocks	100
5	Granite	100
6	Aluminum	100

Table. 5.B.5 % of materials extracted from the products

S. No	Description	Wastage (Kg)	Scrap (Kg)	Landfill (Kg)
1	Steel	2751	2751	0
2	Cement Bag	1840	1840	
3	Tiles	1200		1200
4	Plywood & MDF	30		30
6	Aluminium	40	40	
7	Packaging	300	300	
8	Gypsum	80		80
9	Paint Cans	50	50	
10	Wooden flooring	5		5
11	Miscellaneous	155		155
	TOTAL	6451	4981	1470

Table.5.B.2 Waste Management

INDOOR ENVIRONMENTAL QUALITY AND INNOVATION AND DESIGN PROCESS :

S.NO.	TITLE	REQUIRED	POINT
Prerequisite 1	Minimum IAQ Performance	Required	REQUIRED
Prerequisite 2	Environmental Tobacco Smoke Control	Required	REQUIRED
CDT 1	Outdoor Air Delivery Monitoring	1	0
CDT 2	Increased Ventilation, 30% above ASHRAE 62.1 requirements	1	1
CDT 3.1	Construction IAQ Management Plan, During Construction	1	1
CDT 3.2	Construction IAQ Management Plan, Before Construction	1	1
CDT 4.1	Low Emitting Materials, Adhesive & Sealants	1	1
CDT 4.2	Low Emitting Materials, Paints	1	1
CDT 4.3	Low Emitting Materials, Carpet	1	0
CDT 4.4	Low Emitting Materials, Composite Wood & Agrifiber Products	1	1
CDT 5	Indoor Chemical & Pollutant Source Control	1	0
CDT 6.1	Controllability of Systems, Lighting	1	0
CDT 6.2	Controllability of Systems, Thermal Comfort	1	0
CDT 7.1	Thermal Comfort, Design	1	1
CDT 7.2	Thermal Comfort, Ventilation	1	1
CDT 8.1	Daylight and Views, Daylight 75% of Spaces	1	0
CDT 8.2	Daylight and Views, View 90% of Spaces	1	0
Total		15	8

Table. 6.A.1 Indoor environmental quality CDT Points

Prerequisite 1- Minimum IAQ performance: Intent: Develop minimum indoor air quality (IAQ) performance to stop the development of indoor air quality problems in structure, and contributing to the comfort and well-being of a person in actual ownership of property or land. Requirements: standard ASHRAE 62.1-2004 Should be satisfied.

Mechanical ventilation systems should be designed with ASHRAE 62.1-2004, section 5.1

Approaches: The building has met the fresh air requirement for all the area.

Prerequisite 2 –Tobacco Smoke Control: Intent:- Minimize exposure of people , surfaces and air distribution systems. Requirements:- Stop allowing the smoking in the building. Find any exterior nominate smoking areas at least 25 feet away from entries, outdoor air intakes and operable windows. Approaches:-The project team has declared that the entire campus as a 'Non-Smoking Zone'. The Tobacco smoke control policy has been circulated to all the employees. 'No Smoking' Signage's' have been provided at the interior (Corridors) and exterior (before occupants enter the building) to educate occupants as well as visitors about the 'No smoking policy'.

Construction IAQ Management Plan, During Construction: Intent:- During the construction period indoor air quality should be in sustain the comfort and well being of construction workers building occupants. Requirements: During the construction period, arrange and go over the approve plan Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Principle of occupied Structure under Construction, 1995, Chapter 3. Approaches: The team has established a construction IAQ plan to define the best practices needs to be followed at site to ensure healthy work environment for construction workers during construction and also for the building occupants during the operation. This Plan is build on the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Principle for Occupied Structure under Construction, 1995, Chapter 3. This Plan will be used in conjunction with the project Specific Safety Requirements. OBJECTIVES: The broad intent of this plan is to protect workmen from toxic emissions and dust during the construction. The following are the suggested guidelines to be followed by the contractors during construction. Preventing dust & debris entering to HVAC ductwork and working area during construction. Physical barriers between completed and working areas

Protection of materials and equipment against moisture & dust. Typically this should include cement, AC equipment, Filters, etc., Provide hand gloves and mask to all workmen to ensure safe working environment Keep work place as dry as possible. The Construction IAQ Management Plan shall be organized in accordance with the SMACNA format, and shall address measures to be implemented in each of the four categories (including subsections).

SOURCE CONTROL-DURING CONSTRUCTION: A concurrent approach for maintaining construction indoor air quality is source / pollution control. Objectionable odors created as a part of construction process was properly identified during construction. All finish materials (i.e. carpet, ceramic tile, paints, stains, etc.) are to be covered during the installation.

PATHWAY INTERRUPTION - DURING CONSTRUCTION: All project equipment and material staging areas were located away from critical air flow pathways. Mechanical rooms and air handling equipment areas are not be used as storage space for construction materials and waste. Following measures were implemented before occupancy.1) Erect Barriers to Contain Construction Areas,2) Relocate Pollutant Sources,3) Temporarily Seal the Building.

HOUSEKEEPING - DURING CONSTRUCTION: Construction waste, debris and rubbish were cleaned up during all phases of construction on a regular basis. All lunch papers, cups and other litters are to be placed into trash receptacles. Food and drinks, other than drinking water, was not allowed in the building interior. Cigarette smoking or chewing tobacco was not allowed in the building Interior. Before sealing up a vertical shaft or chase, the bottom area and all surfaces are cleaned for trash, dust, dirt and debris.

SCHEDULING: Scheduling of activities is proven key in helping control of indoor air quality. The installation schedules of all sealants, adhesives,

coatings, paints, etc., are sequenced such that proper venting of objectionable odors accomplished to keep levels below acceptable levels. Included provisions in the Construction IAQ Management Plan for addressing conditions in the field that do not adhere to the Plan, including provisions to implement a stop work order, or to rectify non-compliant conditions. Thermal Insulation materials was covered properly and stored in designated places.

Fig. 6.A.3.11 Thermal Insulation Materials must be covered

Fig. 6.A.3.12 Pathway interruption

Fig. 6.A.3.13 Scheduling

S. No	List of Materials	Application	Adhesive Used	VOC Content Limit for Carpet adhesive (g/l)	Meets the Requirement
Adhesives & sealants:					
1	Sealant	Structural Glazing sealant	DOW CORNING	<30	Yes
2	Adhesive	Laminate Adhesive	Fevicol SH	25	Yes
3	Adhesive	Tile and granite	Laticrete 600	1	Yes
4	Adhesive	Duct adhesive	Fevicol AC duct king	3.84	Yes
5	Adhesive	Wood adhesive	Fevicol SH	3.54	Yes

Table. 6.A.2 Low Emitting materials

Low Emitting Materials, Paints: Intent: Reduce the quantity of indoor air contaminants that are smelly or potentially irritating harmful to the comfort and well-being of installer and building people. Requirements: Paints and coatings used on the interior of the building defined as inside of the weather proofing

system and applied on-site should act according with the requirements of the reference guide.

Approaches:

The following low VOC Paints and coatings has been used in this project

S. No	List of Materials	Application	Paint Used	VOC Content Limit for Carpet adhesive (g/l)	Meets the Requirement
	Paints and coatings:				
1	Emulsion	Interior emulsion	Tractor Emulsion	<50	Yes
2	Putty	Interior putty	Asian wall putty	<100	Yes
3	Primer	Interior primer	Interior primer	<100	Yes

Table 6.A.3 Low Emitting, Paints

FIG. 6.A.14 Emulsion and Putty

Low Emitting Materials, Composite Wood & Agrifiber: Intent: Reduce the quantity of indoor air contaminants that are smelly or potentially irritating harmful to the comfort and well-being of installer and building people.

Requirements: Composite wood and agrifiber products used on the inside of the building must contain no added urea-formaldehyde resins.

Approaches:-The project has used the following Wood and Agri-fiber products, which, is free from Urea formaldehyde resin during its stages of manufacturing. Attached the manufacturer declaration of the same.

	Brand	Resin used	Y/N
1	Green ply-MDF	Melamine formaldehyde resin	Yes
2	Century Laminates	Melamine formaldehyde resin	Yes

Table 6.A.4 Low Emitting Materials, Wood

Thermal comfort: Intent: Thermal comfort shall be maintained in order to get the optimum level of productivity. Requirements: HVAC system shall be designed and building envelope shall be taken into care.

THERMAL COMFORT, DESIGN:-Intent: A comfortable thermal environment that supports the productivity and well being of building occupants must be provided. Requirements: Plan HVAC systems and the building envelope to meet the requirements of ASHRAE standard 55-2004. approaches:-Air-conditioning system is designed, to ensure that inside design conditions are achieved all round the year within the specified range of 23+/- 1 Deg C and average humidity less than 60% @ 100% load and the design is as per ASHRAE 55 2004 requirements. Thermal comfort achieved during summer and winter with respect to ASHRAE 55.1-2004

INNOVATION & DESIGN PROCESS:

S.NO.	TITLE	REQUIRED	POINTS
Credit 1.1	Innovation in Design	1	1
Credit 1.2	Innovation in Design	1	1
Credit 1.3	Innovation in Design	1	1
Credit 1.4	Innovation in Design	1	1
Credit 2	LEED Accredited Professional	1	1
Total		5	5

Table. 9.1 Innovation and design process Credit Points

Fig. 9.11 STP

Credit 1.1 – Innovation in Design: Intent: For exceptional performance above the requirements set by the LEED India-NC Green Building Rating System, the design teams and projects are to be awarded extra points or innovative performance in Green Building categories not specifically addressed by the LEED India-NC Green Building Rating System.

Requirements: In writing, identify the aim of the proposed innovation credit, the proposed requirement for command, the proposed submittals to demonstrate command, and the design approach that might be used to meet the requirements. Approaches: Water Efficient Landscaping: Objective :The broad objective of this innovation credit is project uses ONLY treated wastewater from STP to meet irrigation demand. In this project 100% of the waste water produced by the building will be treated by an Onsite campus STP of capacity 25 KLD which is already in operation. The details of the loading of STP plant are given below: Total installed capacity for the entire campus: 25 KLD, Current loading from admin building and allied buildings: 17.6 KLD, Expected wastewater generation from admin block: 1.6 KLD

Hence the expected loading to the STP works out to be 17.6 KLD. To conclude the current installed capacity of 25 KLD is adequate enough to treat entire wastewater generated from the Credit 1.2– Innovation in Design: Intent: For exceptional performance above the requirements set by the LEED India-NC Green Building Rating System, the design teams and projects are to be awarded extra points or innovative performance in Green Building categories not specifically addressed by the LEED India-NC Green Building Rating System. Requirements: In writing, identify the aim of the proposed innovation credit, the proposed requirement for command, the proposed submittals to demonstrate command, and the design approach that might be used to meet the requirements. Approaches: ECO FRIENDLY HOUSEKEEPING CHEMICALS:

Credit 1.3– Innovation in Design: Intent: For exceptional performance above the requirements set by the LEED India-NC Green Building Rating System, the design teams and projects are to be awarded extra points or innovative performance in Green Building categories not specifically addressed by the LEED India-NC Green Building Rating System. Requirements: In writing, identify the aim of the proposed innovation credit, the proposed requirement for command, the proposed submittals to demonstrate command, and the design approach that might be used to meet the requirements. Approaches:-Water Use Reduction: The project has installed water efficient fixtures in order to achieve water use reduction in a efficient manner. Project is achieving 52% efficient reduction over the threshold.

Credit 1.4– Innovation in Design: Intent: For exceptional performance above the requirements set by the LEED India-NC Green Building Rating System, the design teams and projects are to be awarded extra points or innovative performance in Green Building categories not specifically addressed by the LEED India-NC Green Building Rating System.

Requirements: In writing, identify the aim of the proposed innovation credit, the proposed requirement for command, the proposed submittals to demonstrate command, and the design approach that might be used to meet the requirements. Approaches: GREEN EDUCATION

Objective: The broad objective of this innovation credit is to impart knowledge on Sustainability, Energy, Environment, and Occupational Health & Safety (EHS) through communication, educational & awareness programs to the occupants of the building and to the stakeholders of the project. Credit 2– LEED Accredited Professional: Intent: To support and encourage the plan integration required by a LEED India NC green building project and to streamline the application and certification process.

Requirements: The project team shall have at least one principle participant of LEED Accredited Professional. Approaches: during the project one person was by LEED Accredited Professional that was NISHAY GOWDA.

Conclusions: From the analysis done for the existing building, I concluded that the building has covered all the aspects like site selection, heat island effects, water efficient landscaping, water use reduction, optimize energy performance, ozone depletion, recycled content, thermal comfort low emitting materials etc.. The building is achieving around 40 point and achieving the rating for gold. This building if it tries to maintain or change the building details by small alteration then it can reach up to platinum level. The current rating which is achieved by the building is very much satisfactory but if it is possible for them to do alteration according to the guideline then the building could have got platinum certification. The main outcome of this thesis is to rate an existed building and to know its sustainability and to improve it.

DS MAX Project Checklist

Possible	Maybe	Not Possible			Points available
Sustainable Sites (max 13 points)					
Y			*Prerequisite*	*Erosion and sedimentation control*	*Required*
1			Credit 1	Site Selection	1
		1	Credit 2	Development Density & Community Connectivity	1
		1	Credit 3	Brownfield Redevelopment	1
1			Credit 4.1	Alternative Transportation, Public Transportation Access	1
1			Credit 4.2	Alternative Transportation, Low Emission & Alternative Fuel Refueling Stations	1
1			Credit 4.3	Alternative Transportation, Parking Capacity	1
1			Credit 5.1	Reduce Site Disturbance Protect or Restore Habitat	1
1			Credit 5.2	Reduce Site Disturbance Development Footprint	1
		1	Credit 6.1	Stormwater Design :Quantity Control	1
1			Credit 6.2	Stormwater Design :Quality Control	1
1			Credit 7.1	Heat Islands Effect: nonroof - 50%	1
1			Credit 7.2	Heat Islands Effect: roof -75%	1
		1	Credit 8.0	Light pollution reduction	1
9	0	4			13
Water Efficiency (max 6 points)					

1			Credit 1.1	Water efficient landscaping, reduce by 50%	1
1			Credit 1.2	Water efficient landscaping, no potable use or no irrigation	1
		1	Credit 2.0	Water Efficiency in Air conditioning System: Reduce by 50%	1
1			Credit 3.0	Innovative wastewater technologies	1
1			Credit 4.1	Water use reduction, 20% reduction	1
1			Credit 4.2	Water use reduction, 30% reduction	1
5	**0**	**1**			**6**
Energy & Atmosphere (max 17 points)					
Y			Prerequisite 1	*Fundamental Building systems commissioning*	*Required*
Y			Prerequisite 2	*Minimum Energy Performance*	*Required*
Y			Prerequisite 3	*Fundamental Refrigerant Management*	*Required*
2		8	Credit 1	Optimise energy performance	10
		3	Credit 2	Onsite Renewable Energy, 2.5%,5%,7.5%	3
1			Credit 3.0	Additional Commissioning	1
1			Credit 4.0	Ozone Depletion	1
1			Credit 5.0	Measurement & Verification	1
1			Credit 6.0	Green Power, 50%	1
6	**0**	**11**			**17**
Materials & Resources (max 13 points)					
		1	Credit 5.0	Indoor chemical & pollutant source control	1
		1	Credit 6.1	Controllability of Systems, lighting	1
		1	Credit 6.2	Controllability of systems, thermal comfort	1
1			Credit 7.1	Thermal comfort, Design	1
1			Credit 7.2	Thermal comfort, Verification - 6 to 18 months	1
		1	Credit 8.1	Daylight & Views, daylight 75% of spaces	1
		1	Credit 8.2	Daylight & Views, Views for 90% of spaces	1
8	**0**	**7**			**15**
Innovation & Design process (max 5 points)					
1			Credit 1.1	Innovation in design (water efficient landscaping)	1
1			Credit 1.2	Innovation in design (Green Housekeeping chemicals)	1
1			Credit 1.3	Innovation in design (water use reduction)	1
1			Credit 1.4	Innovation in design (Green education)	1
1			Credit 2	LEED accredited professionals	1
5	**0**	**0**			**5**
				Total Maximum Points	**69**
40	**0**	**28**	Certified 26-32 points, Silver 33-38 points, Gold 39-51 points, Platinum 52-69 points		

Table 10.1 Final Checklist

REFERENCES

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[9] http://www.yourarticlelibrary.com/essay/essay-on-green-building-movement-in-india/27347
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[11] http://www.thehindu.com/business/Industry/india-can-lend-leed-certified-consultants-to-the-world/article20231073.ece
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