
A.T.E. Pune

Text
A.T.E.
RMA Architects
Architecture Foundation

Photography
Rajesh Vora
Robert Stephens
Tina Nandi

Book Design
Studio Anugraha, Mumbai, India

Architecture Foundation Team
Shivani Shah
Harsh Jain
Ela Singhal

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A.T.E. Pune

ARCHITECTURE FOUNDATION

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01 INTRODUCTION

A.T.E. is an engineering group that creates products and technologies, living by the values of sustainability, care, commitment, openness and innovation. The operations of the group require us to have our own laboratories, assembly and manufacturing spaces, and collaborative offices.

Our workspace in Pune houses key operations of several of the group's business units: EcoAxis (Internet of Things or IoT); Axis (vision systems); Flow Technology (liquid transfer and control systems) and HMX (energy-efficient cooling). While creating this facility, our aspiration was to produce an environment that echoes our values and enhances our effectiveness at work. We want our offices to be functional - comfortable, user-friendly, supporting our 'do-it-yourself' style, allowing people to walk around, and talk and work together, thereby negating any sense of hierarchy. The aesthetic should be 'unfussy', with clean lines and durable finishes; to paraphrase a quote from Einstein, "everything should be as simple as possible, but no simpler."

As a firm designing thoughtful and high-tech products, we need workspaces that are calm, foster collaboration, enable prototyping and testing, and can be re-configured if needed. At the same time, we want to be environmentally conscious and showcase our own ideas and our 'green' products for health and comfort. We are happy to have assembled a team that is diverse in skills but unified in purpose, thereby helping us achieve our goals.

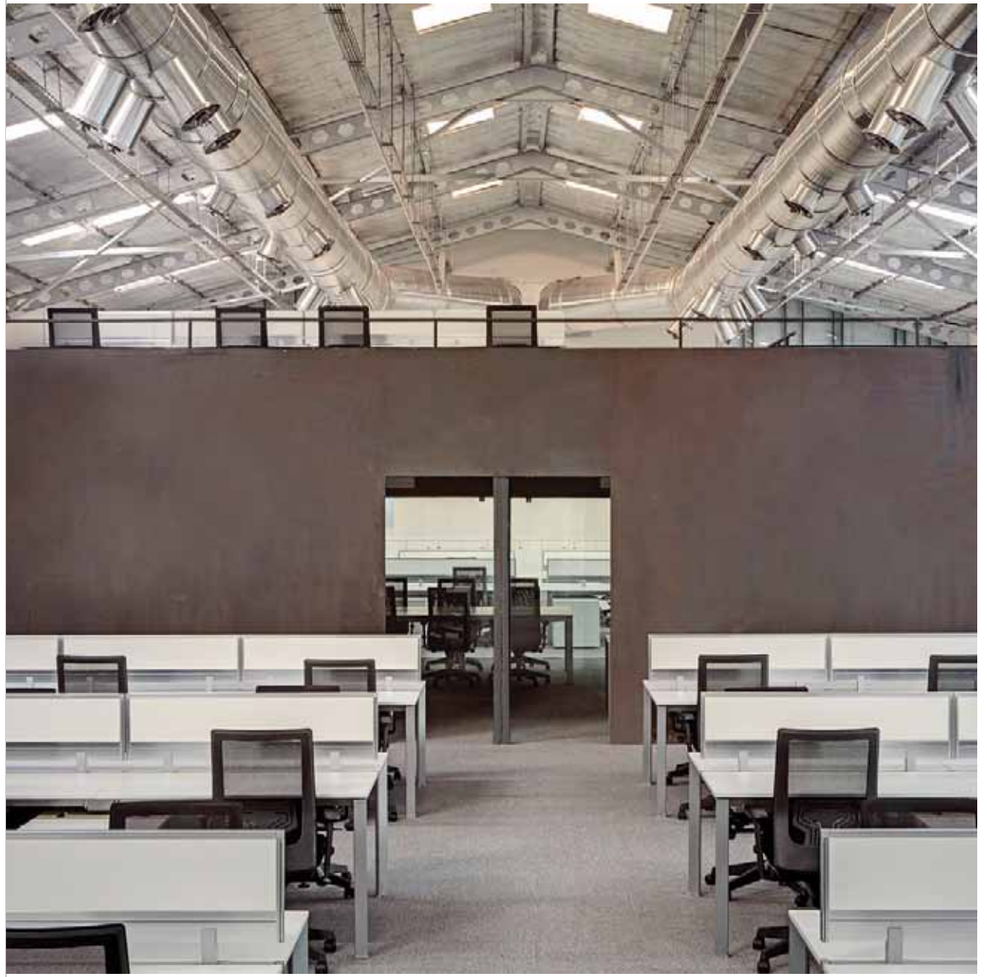
View of green court between office and pavilion

02 DESIGN BRIEF

The A.T.E. facility at Bhosari serves multiple business units of the A.T.E. group, each of a different nature. The buildings also serve various programmes, including manufacturing, testing, warehousing, design, sales, and administration. The intention at the A.T.E. facility is to create a pleasant work environment that responds to the aspirations of the company in terms of its work culture and shared goals.

The construction of the built environment is envisioned as a combination of appropriate local technology and culture-specific spatial practices, ensuring relevant aesthetics and efficiency of the built form. The brief also specified the need for localised air conditioning in specific spaces, leaving other areas to be cooled through passive methods or through systems that involve fresh air circulation.

The programme brief for the office building comprises spaces for EcoAxis and Axis, including their assembly operations, a warehouse for the Flow Technology group, open office spaces for several A.T.E. business units, working cubicles, and storage areas. The conference and meeting rooms along with the reception, display area, waiting areas, dining space and pantry are shared by the EcoAxis, Axis, Flow Technology and HMX business units of A.T.E. The relationship between different spaces was to be organised in a manner which breaks away from typical office spaces that otherwise imply strict hierarchies.

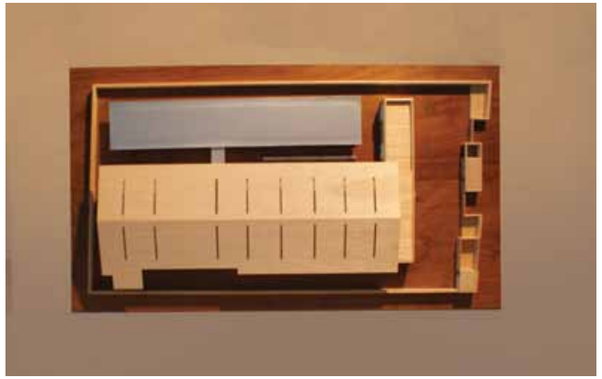


DESIGN APPROACH

The design of the office responds to factors such as climate and orientation, and integrates a complete retrofit of an existing dilapidated factory building on the site. This approach enables the building to function more efficiently, not only in terms of comfort but also through spatial integration, and creates an environment that facilitates interaction.

The comfort of users and their productivity levels are enhanced by countering the existing local conditions of extreme heat, dryness, and variations in temperature through the day and year through protection of openings and the creation of semi-open spaces.

The complex is conceived, designed and built as an environment-friendly facility that meets LEED and other green building certification requirements. This was achieved through various approaches such as enabling the use of renewable sources of energy, reusing unused material from the existing structure, and making material and building service choices that reduce the carbon footprint and consumption of water. Appropriate technologies have been integrated to enhance the user experience by creating comfortable and healthy environmental conditions with optimised energy utilisation.

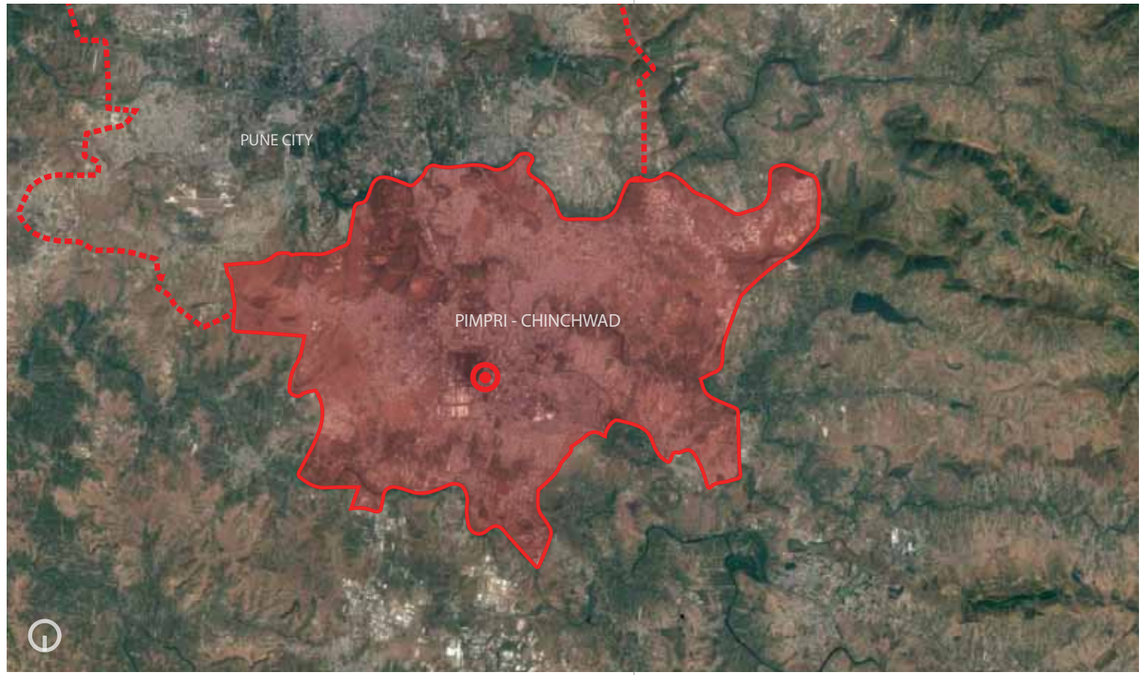


MODEL IMAGES

LOCATION

The A.T.E. campus is about 600 meters off the NH 60 highway connecting Pune and Nashik, and lies in the Maharashtra Industrial Development Corporation (MIDC) area of Bhosari, near Pune. This industrial area is about 15 kilometers away from the main Pune city, 165 kilometers from Mumbai, and connected to both by major highways lined with industrial belts. The MIDC area is part of the urban agglomeration of Pimpri - Chinchwad, on the Pune - Nashik Highway. Spread over an area of 170 square kilometers, the area has a large number of automobile, pharmaceutical, information technology, and manufacturing companies.

The size of the plot is 2,300 square meters, and the plot boundary is shared with industrial units along three sides. After carrying out a detailed review and structural audit of the existing factory building, it was decided that the skeleton structure with the columns and trusses should be retained, while the roof was to be dismantled and replaced. Moreover, new blocks were added to accommodate the requirements of the company, which led to the challenge of working within the constraints posed by the factory structure, which restricted the area in which the programme was to be housed.



2005

2017

LOCAL CONDITIONS

Latitude: 18.2°N
Longitude: 73.8°E
Climate: Hot and dry

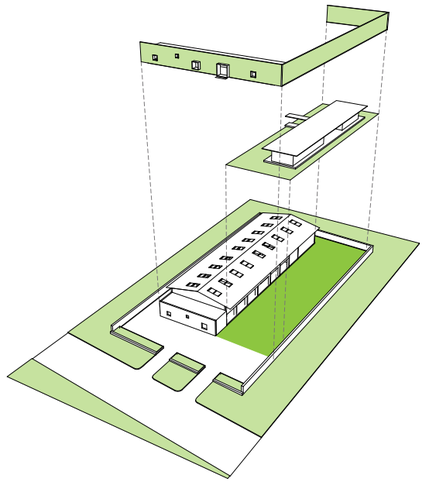
The Bhosari region experiences hot and dry weather, with extreme temperatures, low humidity and mild rainfall. Thus, designing a 'green' building in such climatic conditions is a challenge as environment-friendly building technology has to be adopted with creativity. Passive methods of cooling were integrated within the architectural design itself, along with the use of low-energy consuming systems for the cooling of the building.

Plot boundary
Existing structure
Proposed extension

PROPOSED EXTENSION IN RELATION
TO THE EXISTING STRUCTURE

The vision for the A.T.E. facility was to create a contemporary facility that respects the environment and local context. At the site for the office, an existing structure is used as a starting point to retrofit the workplace facilities within a structural framework, ensuring a cost-effective and sustainable design solution. With minimum intervention, a unified façade has been created for the building, lending it a new identity within the context.

In its programmatic disposition, the office building is organised in a manner that locates the spaces dedicated to social functions closer to the entrance; private areas of the office deeper within the building; and service areas located at the rear end.

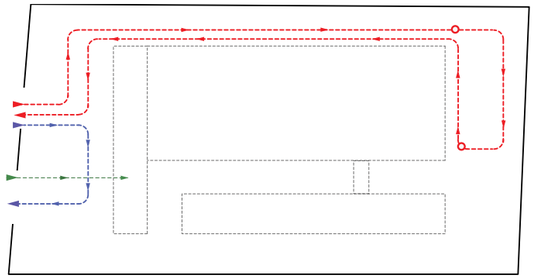


EXISTING STRUCTURE
AND PROPOSED EXTENSIONS

FACING PAGE: Social spaces open out to green courts on both sides. The flexibility of spaces allows different permutations of social interactions.

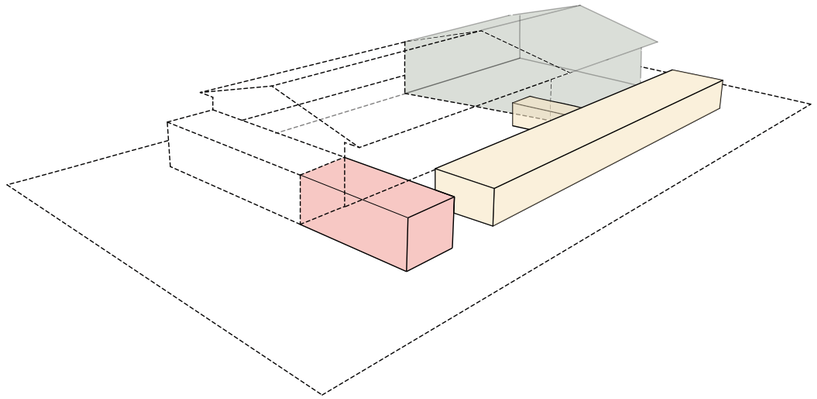
MASSING AND RELATION TO SITE

The A.T.E. office uses the structure of the existing single-storey factory with its voluminous space as an opportunity to design an open plan. Two blocks are added to the existing structure - to the north is a pavilion and in the front of the site are the reception and other external interaction spaces. The entrance block is perpendicular to the existing building to create a new facade for the facility, and the pavilion is connected to the office building through a central open court. By extending the structure in the same design language on the west end, the factory and warehouse are accommodated in the building with the service core as a buffer.



Drop-off
Service vehicle access
Vehicular employee access
Pedestrian access

SITE CIRCULATION



Existing structure
Interaction block
Workshop | Factory
Cafe + services

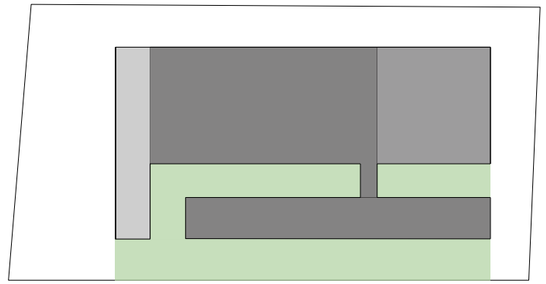
ADDITION TO EXISTING BLOCK

ZONING

The office facility is divided into distinct zones with an entrance interaction block, open office, factory and warehouse, cafeteria, and service areas. At the entrance is an area for visitor interaction, comprising a display space, reception, and meeting rooms. The open office is accessed through the reception and has workstations split over two levels. With a limited skeleton for the office space, a mezzanine floor is added to accommodate the desired number of workstations. Part of the ground floor under the mezzanine floor is designed to house cabins and meeting rooms for team discussions. The manufacturing and assembly spaces as well as the warehouse are located at the rear end of the office building, separated by a service block. The factory has a separate entry from the rear end that ensures minimum disturbance to the more formal areas of work. A mezzanine in the factory is used for workstations while the lower floor accommodates the factory equipment installed.

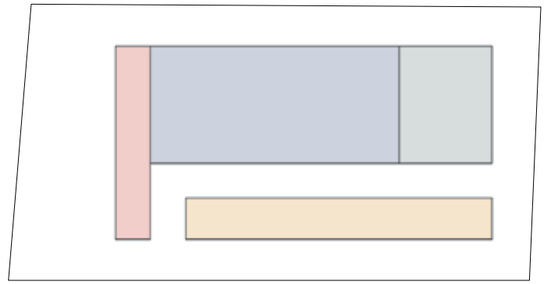
An open-air pavilion to the north is separated by a green court from the main office area and is accessed by a covered passage. Designed as an open space with no walls and a low roof, the pavilion houses the cafeteria and other storage and service areas.

The green court between the buildings is split into two zones by the connecting passage where the front acts as a visual buffer for the formal areas, and the rear as a service court.



Private
Semi-private
Public
Green courts

PUBLIC AND PRIVATE ZONING



Interaction block
Open office
Workshop | Factory
Cafe + services

SITE PROGRAM ZONING

SITE PLAN

The new A.T.E. facility is planned to guarantee safe and efficient vehicular and pedestrian movement. The vehicular access to the factory and the warehouse for freight - handling is designed along the south façade with minimum openings in the wall of the office, ensuring the least disturbance inside. Service vehicles have a small sit-out at the rear and an efficient area to reverse the vehicle for exit along the same path. Pedestrian movement is planned along the central axis that connects the entrance to the central court through a large opening in the display gallery.

The main entry and exit, just off the main access road, also act as control points for employee vehicles and trucks for factory - and warehouse related services. A separate pedestrian entry leads to the reception directly, and provides an unobstructed visual link to the central court. A paved area in the front acts as a transition space for the building complex and provides parking space for vehicles of employees and visitors alike.

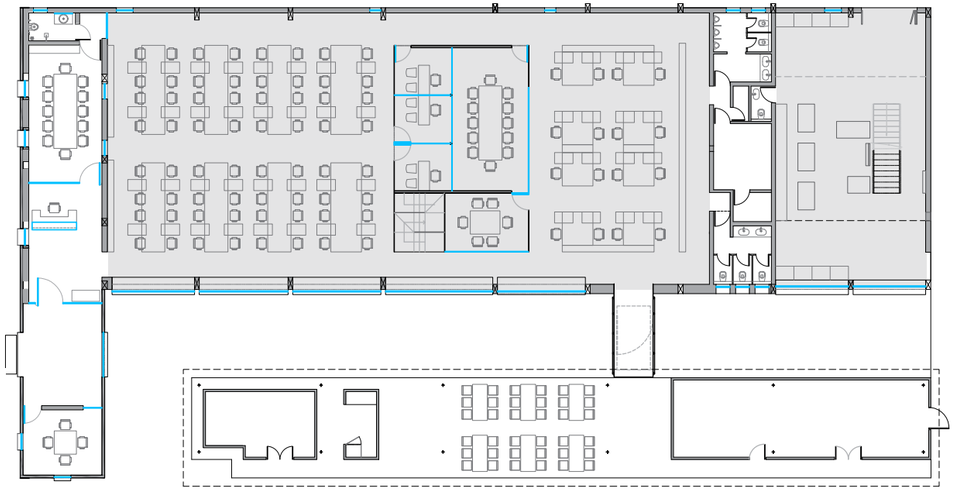
FACING PAGE: View of the entry facade. The large opening in the reception display visually connects to the central court

OPEN-PLAN OFFICE

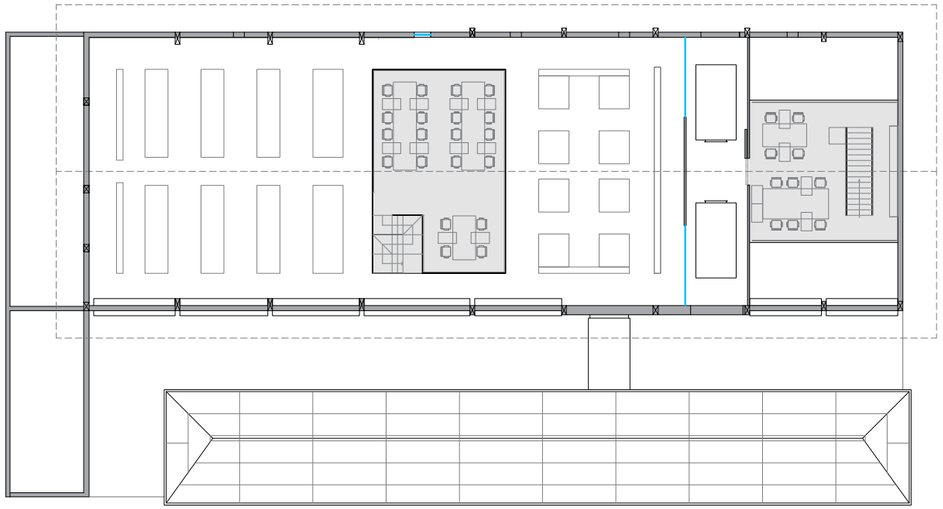
An open-plan office is one which is devoid of vertical partitions between team members of different levels. Such a layout facilitates interaction as well as accessibility among colleagues. Open-plan offices are also architecturally and experientially beneficial, because the elimination of vertical partitions ensures the free movement of air and maximises natural light.

The workspace consists of three large separate zones within the office — two on the ground floor on either sides of the mezzanine and one at the mezzanine level. Meeting rooms below the mezzanine are well connected to the workspaces and offer privacy when meetings are to be conducted.

GROUND FLOOR PLAN



FIRST FLOOR PLAN



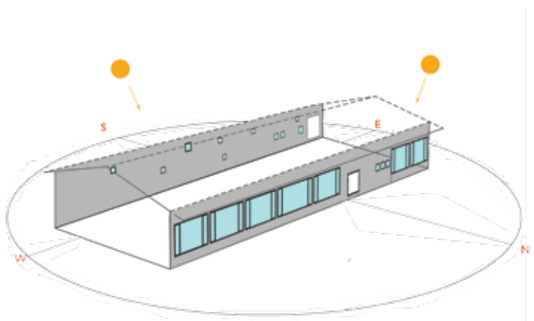
OPTIMISING DAYLIGHT AND REDUCING HEAT GAIN

Apart from energy conservation, well-lit workspaces have proven to yield specific benefits like better health, increased productivity, and reduced absenteeism among staff. Several strategies have been adopted to optimise natural light and reduce solar heat gain.

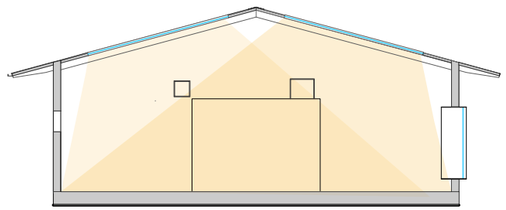
To ensure that the interior spaces of the office and factory building are washed in natural light, the façade is detailed with large glass windows towards the north and smaller windows towards the south. Fenestrations are arranged along the façade in direct response to adjacent interior programmes. The open court to the north of the building lets sunlight enter through the large north-side windows. The transparency and light structure of the pavilion and strategic openings on the east and west façades of the administration block building ensure adequate penetration of daylight to the entire building.

Skylights in the roof optimise day-lighting in the office, taking into account factors such as rain and ventilation.

Planters on the flat roof of the administrative blocks function as over deck insulation helping to reduce heat gain. A double-layer roof with an air gap and low emissivity film on the inner surface also reduce heat gain and minimize noise transmission. The low emissivity inner surface of the roof reduces the heat radiated from the roof into the open office space.



LARGER OPENINGS ON THE NORTH, SMALLER ON THE SOUTH



ROOF SKYLIGHT

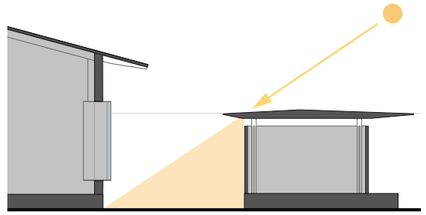
FACING PAGE: View from the work area looking towards the green court.

SHADING

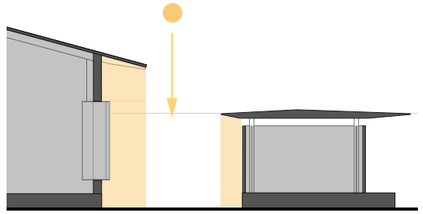
According to the Energy Conservation Building Code (ECBC), a west-facing overhang with a 0.35 projection factor (i.e. the ratio of a 3.5 metres internal clear height to a one metre overhang), provides a 20% reduction in solar heat gain, as compared to an uncovered window.

A one metre overhang is incorporated on both southern and western façades. The pavilion has large overhangs and receives shade from the office building located along the south and east sides. Even around noon in summer, when the sun is overhead, the projected roof of the pavilion lends shade to the spaces inside and provides a comfortable area for dining and informal interactions.

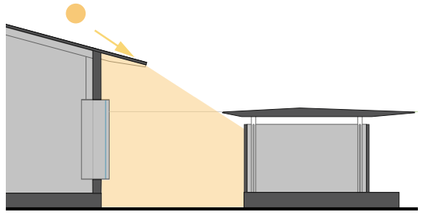
The central court is interspersed with trees and covered by buildings on three sides. Towards the front and back of the site, large banyan trees provide shade and frame the perimeter of the site with natural foliage.



MORNING



NOON



EVENING

SKYLIGHT SECTIONAL DETAIL

FACING PAGE: View from the courtyard looking towards the connecting passage

COOLING AND ENERGY EFFICIENCY

The design breaks away from the conventional office building typology of an air-conditioned glass box so that the structure does not rely completely on external sources of energy. The building includes naturally ventilated spaces that help maintain temperatures, thereby making space suitable for use even during the summer months. The indoor and outdoor spaces almost flow into each other as one traverses through the building. Some of these spaces can, in fact, be used as informal extensions of the office and meeting spaces.

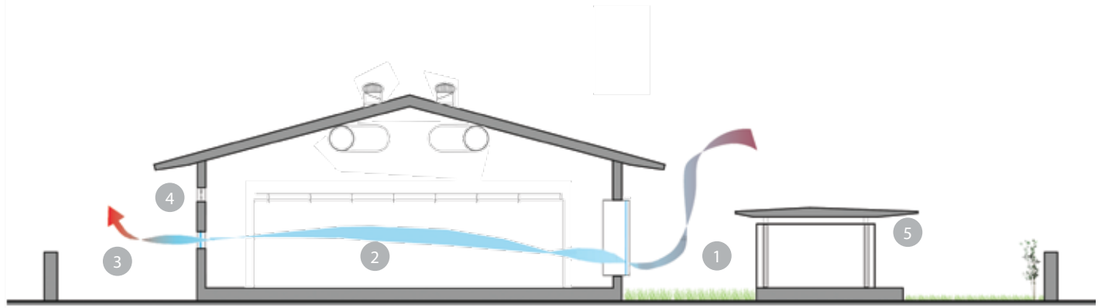
The integration of passive ventilation into the design process of the A.T.E. buildings – i.e. the movement of air through a building without the use of externally supplied energy - has ensured that non-air conditioned spaces remain cooler, thereby saving energy and providing a comfortable working environment. Large openings along the courtyard allow cool air to enter the building and flow out through small openings towards the south, which also integrate exhaust fans to enhance air flow.. The open cafeteria with greenery on both sides and low-height walls create continuous air circulation, thus making the atmosphere healthy and comfortable for users.

The air-conditioning system in the ASHRAE base building used as reference for this project is estimated to consume more than 72 MWh annually or 38% of the total annual energy consumption. The design of the office thus incorporates several features that will help reduce the energy consumed by air-conditioners. Passive features such as the double-layered roof with a low-emissivity surface on the inside and smaller openings with large overhangs on the south façade reduce solar heat gain and hence, load on the cooling system.

New technologies have been integrated to create a working environment that is comfortable as well as energy-efficient. The "mixed - mode" air-conditioning system, which permits both natural ventilation and mechanical cooling, helps achieve a comfortable working environment. The most amount of energy saved sustainably is from the use of Ambiators. These machines, based on a novel indirect evaporation cooling technology and intelligent air volume controls, together with the passive features save around 60% of the energy consumed by conventional refrigerant-based air-conditioners. Since the Ambiators work on fresh air, they ensure a healthy working environment with acceptable levels of carbon dioxide, and free from stale odours that might accompany air recycling. Additionally, they are an A.T.E. group product, designed and built by A.T.E.'s business unit - HMX.

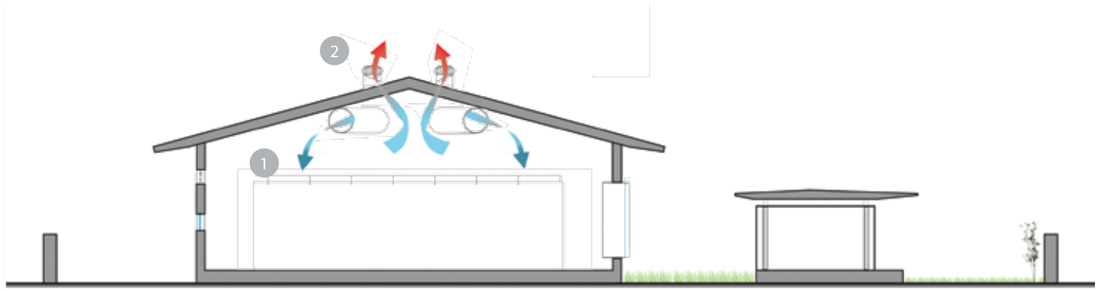
The maximum temperature complies with the recommendations of ASHRAE's Adaptive Model of Comfort and is designed not to exceed 28°C inside the office space during the peak of Pune's summer. The extensive use of daylight in combination with using LED fixtures instead of conventional lighting systems cuts the energy spent by another 8%. The roof is designed so as to be largely covered by solar panels to produce electric energy for the facility, the installation for which will be done at a later stage.

Energy consumption in the production processes as well as in running all building systems is continuously monitored, and efforts taken to systematically reduce the energy consumed in the process of manufacturing each product, as well as in maintaining comfort and using the building. The building monitoring systems are conceptualised, designed, and manufactured by EcoAxis, a business unit of A.T.E.



PASSIVE VENTILATION

1. Courtyard vegetation creates a cooling buffer
2. Cross ventilation allows for passive heat extraction
3. Hot air moves upwards
4. Exhaust fan
5. Grills in pantry and storage



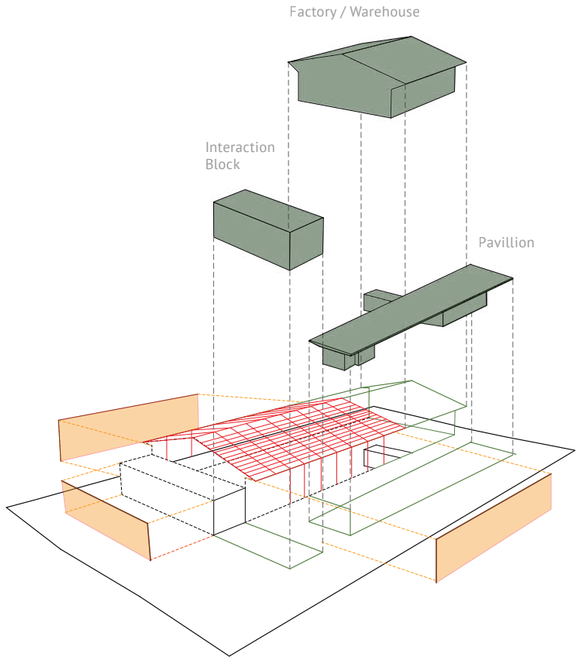
MECHANICAL VENTILATION

1. Cool air blowing from the duct
2. Hot air moving out from exhaust

RE-USE STRUCTURE

The initial phase of design involved studying an existing building on the site itself. Once the structural audit was complete, the building envelope of the factory was chosen to be reused.

The programme for the office building was retrofitted in this existing structural envelope to maximise spatial availability and conserve available resources. By retaining the columns and truss structure of the roof, additional construction was avoided. This was instrumental in reducing the embodied energy and the consumption of material on site, along with reducing the cost of construction. The office building has retained its original steel structure for an obstacle - free, low-maintenance ceiling, along with an inverted structural system that eliminates the need for false ceilings, and which helps achieve maximum ceiling height, especially crucial as the office accommodates a mezzanine floor. The building material that was dismantled from the existing structure was recycled in the construction of the new building.



ADAPTIVE RE-USE STRATEGY

Existing Built

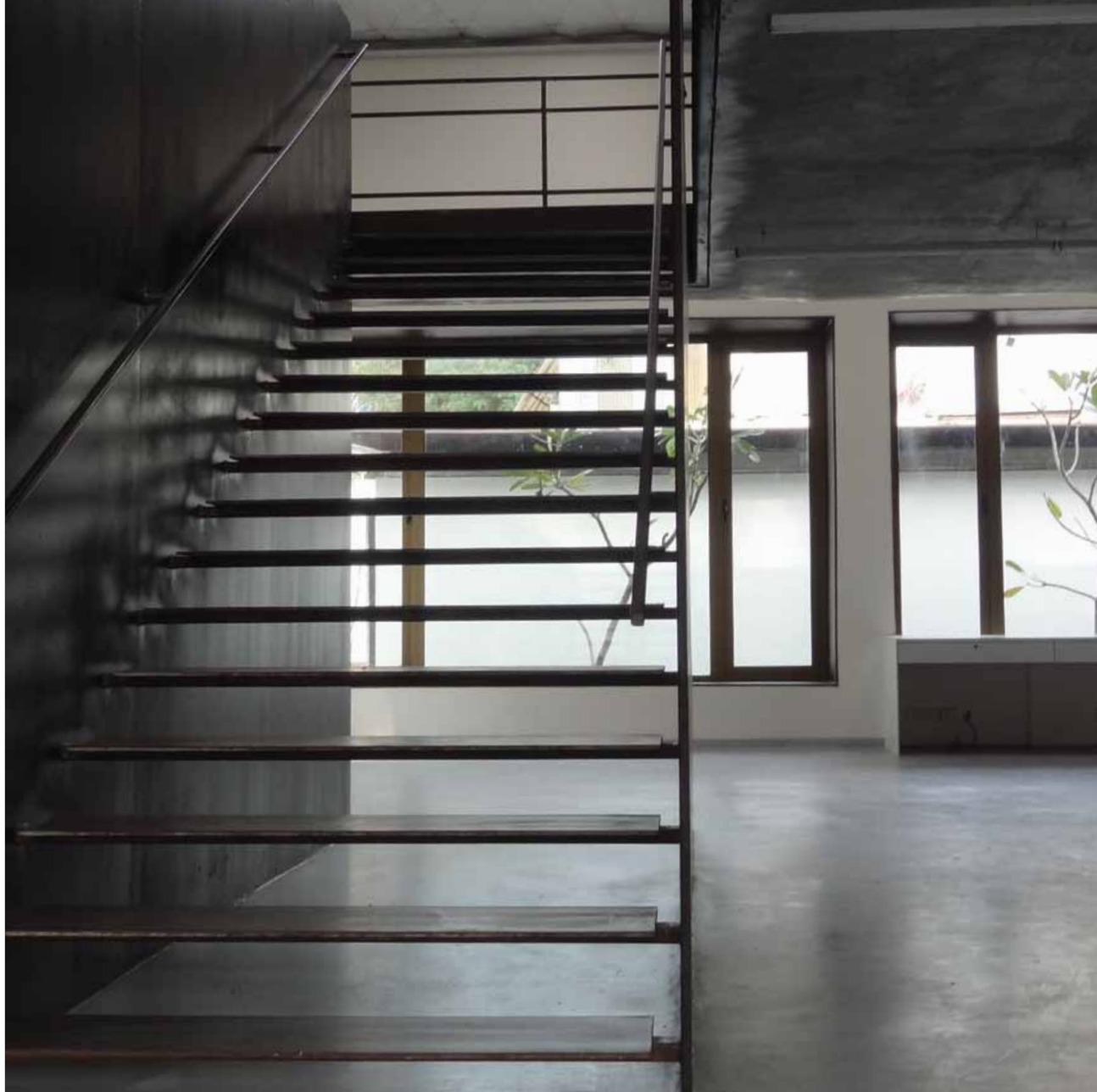
MATERIAL + TEXTURE

The building facilities for A.T.E., a technology-oriented group, are designed in such a way that the building systems are exposed, and structure and building technology co-exist as integrated, architectural elements of the building.

The extension wall of the administration block that acts as the entry façade is finished in exposed concrete and is pigmented in some sections to add richness to the elevation of the building.

Architectural elements such as protective boxes for openings; the staircase; the mezzanine structure in the office space; the connecting passage to the pavilion; and the columns and roof of the pavilion are all made using weathered mild steel, thus creating a consistent aesthetic and visually resonating with A.T.E.'s background as a manufacturer of engineering products.

FACING PAGE: Workshop looking towards the central court



LANDSCAPE

The directions ensure that the long façades of the building face the north and south. Both long edges of the building are adjacent to large landscaped patches which yield a cooler micro-environment. The planting of lemongrass on the roof of the front part of the office building keeps the interiors cool. Tall bamboo are positioned along the edges of the boundary wall to provide a visual buffer from the neighbouring property. The courtyard between the open office and the pavilion is planted with champa trees and tall grasses which are ornate and decorative, and facilitate a cooler micro-environment in the adjacent buildings.

All species used in landscaping the site are indigenous varieties. This not only reduces procurement and transportation costs, but also reduces water consumption. Moreover, the plantation then has a better chance of thriving and remaining healthy in the long term.

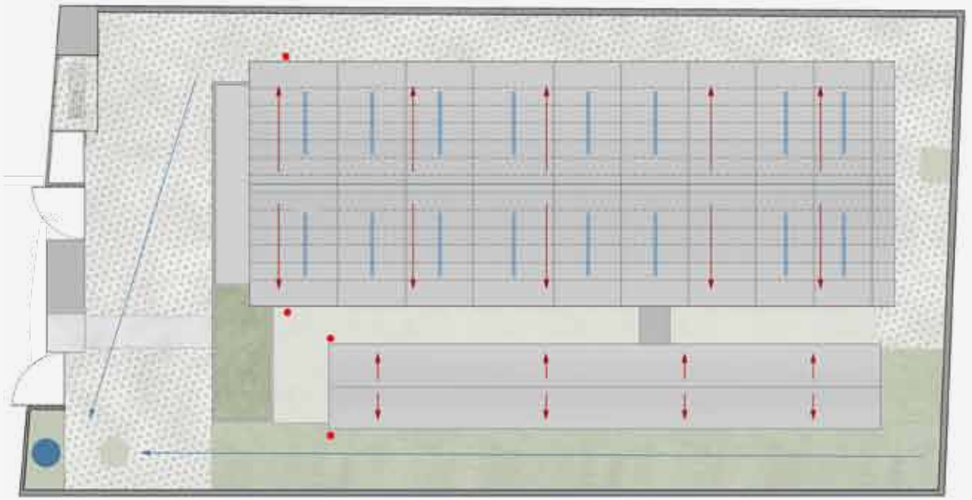
Champa trees and tall grass 1
Low grass 2
Terrace garden 3
Banyan tree 4
Open - cell pavers 5

FACING PAGE: View from the reception looking towards the central green court

WATER

A rainwater harvesting system over the entire site collects rainwater from building roofs and paved areas, filters this water and then recharges to the ground.

The manufacturing processes at the factory do not require water. Water is consumed for the use of employees and the purpose of landscape. Furthermore, the Ambiators used (for the most part) in the air-conditioning systems use water to exhaust heat from indoor spaces to the outside. Since the site is spread over a large area, and water consumption is only restricted to a few areas and limited in nature, this A.T.E. campus is designed to be water neutral.



Rainwater collection point
Roof slope
Site drainage
Site discharge pit

RAINWATER HARVESTING SYSTEM

MONITORING SUSTAINABLE OPERATIONS

A.T.E.'s desire is to continuously measure and verify various aspects of the buildings performance and operation to quantify energy and water used and conserved. The plan is also to use this system to monitor equipment manufactured / used by A.T.E. group companies for design verification.

The monitored parameters are broadly classified as:

1. Electrical energy consumed by lighting and factory loads.
2. Electrical energy consumed by cooling systems such as the HMX Ambiators.
3. Electric energy produced on site.
4. Indoor Air Quality (IAQ) parameters like CO_2 levels, temperature and humidity at specific points in the factory and the office.
5. Water consumed and re-used in the facility.

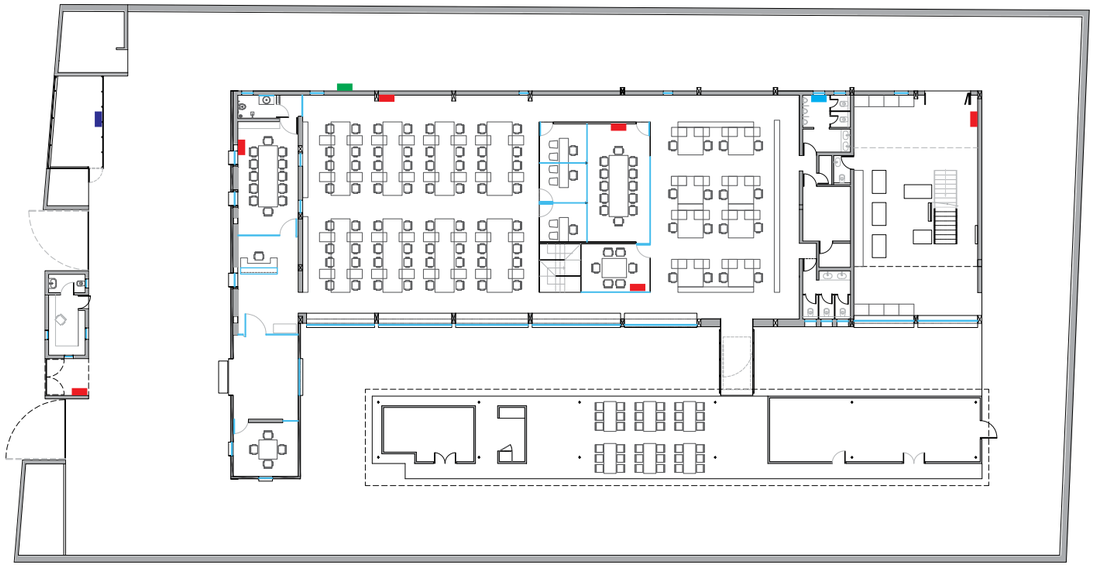
The monitoring is implemented by A.T.E.'s business unit EcoAxis deploying Internet of Things (IoT). The solution broadly includes IoT gateways for data acquisition and the cloud-based SuperAxis™ platform to store and view data, reports and notifications. The hardware includes sensors as well as gateways. The SuperAxis™ platform on the cloud performs data storage and advanced analytics. Users can log on to the server using a standard web browser. They also get "alerts" and "acts" over SMS or email.

Ambiator panels

Indoor air quality and occupancy panels

DIAGRAM OF THE MONITORING SYSTEM NETWORK

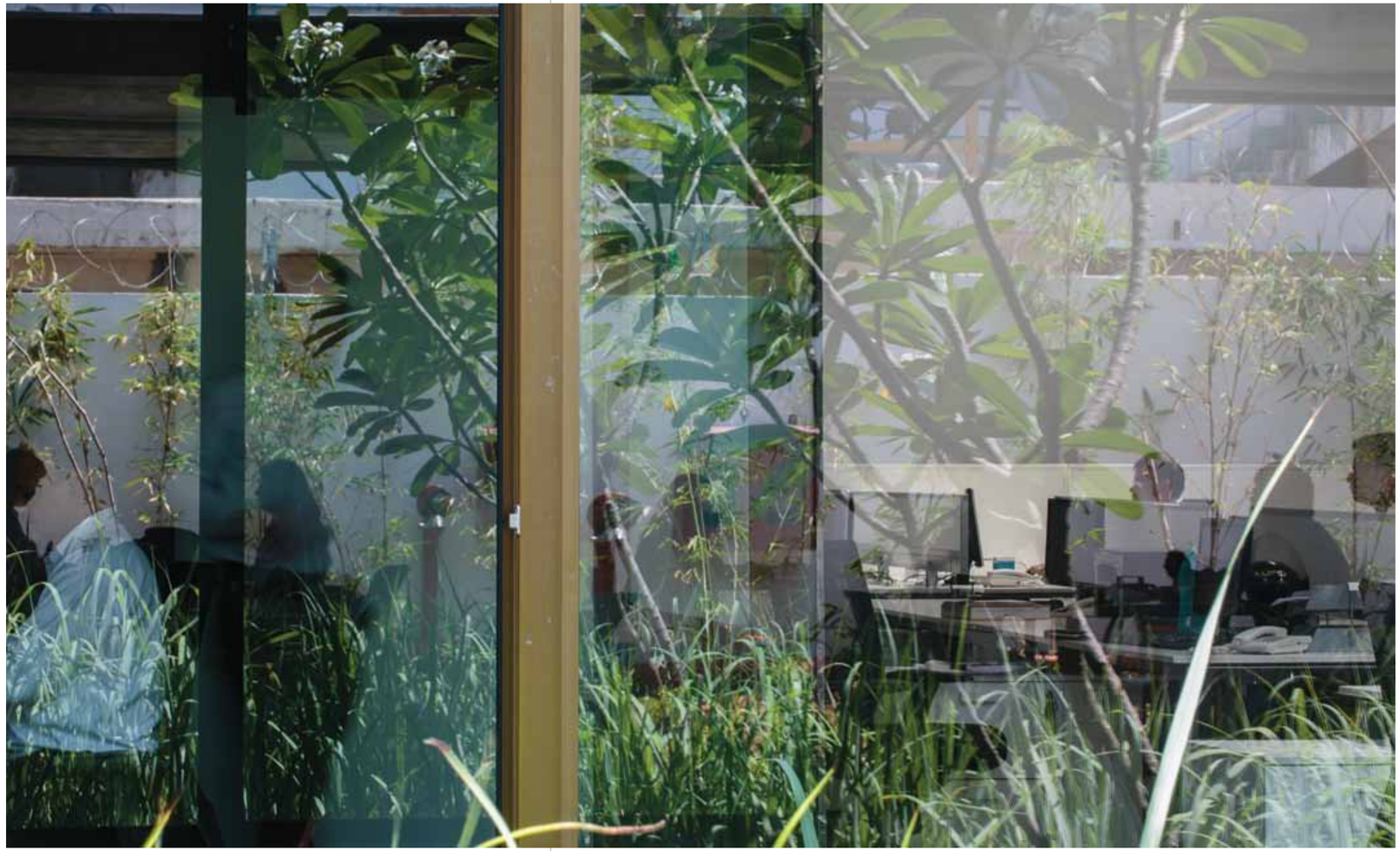
Temperature, RH, CO_2
DG fuel consumption meter
Temperature and RH
Ambiator water flow



LOCATION OF PANELS

06 TEAM WELL-BEING

As the pace of technological innovation intensifies and human beings are asked to process more information and perform increasingly complex tasks, it becomes important for architectural design to respond to these needs. Building design is a critical tool in the promotion of societal health and well-being, yet there remains a radical disconnect between the physical expectations placed on workers and the architectural response to such demands. A thoughtfully designed space can increase productivity, foster a sense of community, and minimise environmental impact. Minimal design ensures calm and comfort, while the use of Ambiators and green, open spaces ensures plenty of healthy, fresh air.

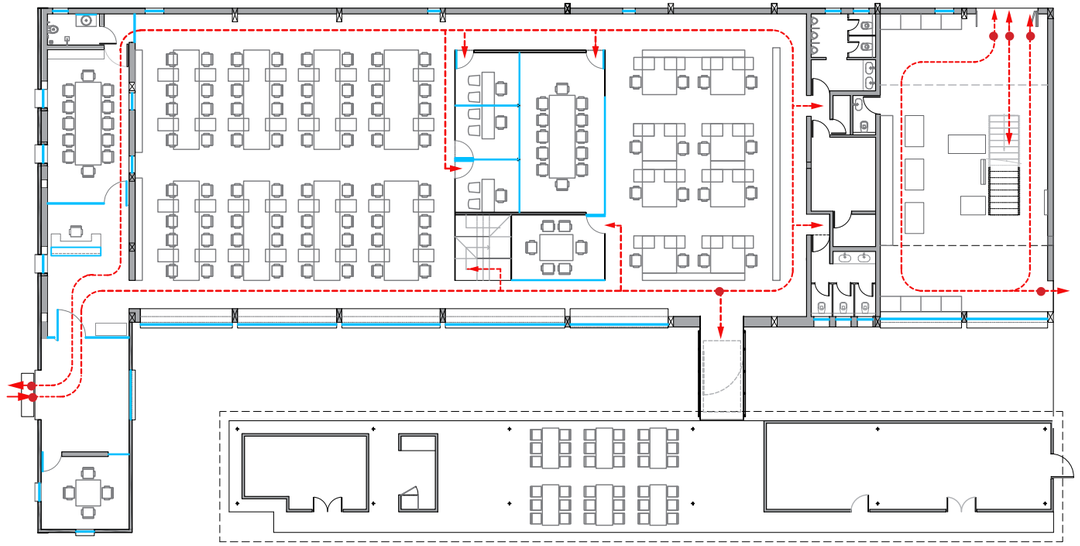


SAFETY

1. The open office is planned so as to ensure swift and easy evacuation. Each cluster of workstations is separated by wide corridors that act as escape routes from the office in times of emergency. Exit points are planned uniformly, and have minimum obstructions as per safety regulations for an office building.

2. Adequate measures have been taken to ensure safety of the people working in the building. In case of fire, smoke sensors and fire alarms are installed at planned locations and fire fighting equipment is set up at easily accessible points.

3. The segregation of pedestrian and vehicular traffic on the campus also reduces the chances of accidents.



Entry and Exit Points

ENTRY AND EXIT POINTS IN THE BUILDING

USER COMMENTS

"Natural lighting in common office areas with green grass around the place offers a very refreshing look at any time of the day. I never felt tired or heavy sitting anywhere in the office."

- Raju Halbe - Director and Advisor A.T.E. group

"The open office created an entirely new culture – a culture beyond functions, divisions and technologies. Each had a desk with a view, and everyone enjoyed the clean, fresh and green surroundings. The interactive workstations enabled physical movement."

- Francesca Keeki - HR and Administration

"The natural cooling is something which we like very much; the well-laid out lawns with paved blocks outside our unit are very refreshing to look at. We enjoy having a relaxed meal or a cup of tea with our colleagues in the cafeteria."

- Shajith Thottiyan - Manufacturing, EcoAxis

"The cooling with Ambiators beautifully complements the overall theme of "creative work spaces". The 100% fresh air and natural water-based cooling is a big boost for the morale of our people working here. The seamless office gives an overall feeling of openness and a conducive environment for creative working."

- Sunil Tiwari - Head, Domestic and International Sales, HMX

07 CONCLUSION

The A.T.E. facility, while being an autonomous intervention on the site, is perceived to be successful at two levels:

Firstly, the facility meets the functional needs of its users and has created a desirable and sustainable environment for work. The building serves as an appropriate representation of the values of the A.T.E. group of companies, reinforces its commitment to the health and comfort of its team, fosters social interaction among its employees, and demonstrates the range of products that A.T.E. engages with.

Secondly, it has integrated the existing structure on the site both as a move to conserve existing resources as well as the memory of what existed on the site and context. The extensions are designed to complement the existing conditions and create a façade for the building that generates a new identity. The liberal use of landscape in the court and areas surrounding the buildings further enhances the perception of the building being embedded in the location.

In this sense, the A.T.E. facility at Bhosari is an appropriate response to multiple aspirations, both at the level of the site as well as functional requirements of the users.

TECHNICAL DESIGN

SITE	Location	Bhosari, Pimpri-Chichwad (15 km. from Pune)
	Latitude - Longitude	18.6°N - 73.8°E
	Climate	Hot and dry
	Total area	0.5 acres
BUILDING	Building type	Office and factory
	Office area	9,930 ft^2 / 922 m^2
	Factory area	2,655 ft^2 / 250 m^2
PRODUCTS MANUFACTURED		EcoAxis IoT hardware and software, Axis vision systems and Flow Technology systems.
GREEN FEATURES	Energy efficiency	Natural day lighting (openings and fenestrations, skylights)
		Building shadings
		LED lights
		Double-layer office roof with a low-emissivity surface on the inside
		Low-Ɛ coating on roof.
		Multiple evaporative cooling systems: total capacity more than 143,000 cfm.
	Water efficiency	Rainwater harvested on entire site
	Enhanced Indoor Air Quality (IAQ)	Cool and fresh air supply, passive ventilation, CO_2 monitoring plants
	Energy Performance Index (EPI)	117 kWh/m^2 - year (measured over February 2015 - January 2016)
	Building certification	LEED Gold Certification

DESIGN TEAM

CLIENT	A.T.E. Enterprises Private Limited
DESIGN ARCHITECTS	RMA Architects Pvt Ltd / Mumbai + Boston Rahul Mehrotra, Robert Stephens, Payal Patel, Shravan Kamath
STRUCTURAL CONSULTANT	U.D. Chande Consulting Engineers
SERVICES CONSULTANT	Arkk Consultants
INTERIOR DESIGN	RMA Architects Pvt Ltd / Mumbai + Boston
CIVIL CONTRACTOR	Aaryan Devcon
INTERIOR CONTRACTOR	Aaryan Devcon
LANDSCAPE CONTRACTOR	Rahul Harishchandra
BUILDING MODELLING	Energy Efficiency Solutions, A.T.E.
COOLING SYSTEMS	HMX, A.T.E.
REMOTE MONITORING AND ANALYTICS	EcoAxis, A.T.E.