



India Chapter

ASHRAE INDIA CHAPTER

For the
HVAC&R
Industry

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BULLETIN

From the Desk of the Editor

Ashrae India Chapter comes up with another issue of the newsletter for the period November 2019 – March 2020. The period was full of activities, which included many routine programs, DL Visits, Workshops, Student Chapter activities and ofcourse the flagship event of AIC in 2019. All the programs are covered along with pictures of the event. This year AICTECH was on "Sustainability Practice - Building Sustainable Hotels". The program is covered in detail in the newsletter. We had three DL visits to the Chapter and Sub-chapters.

This year three new fellows from India were recognized and two fellows were selected from Ashrae India Chapter viz; Mr. G.C. Modgil, an eminent HVAC Consultant, Mr. Uma Shankar Garg – an eminent HVAC component manufacturer. Ashrae has started RAL Regional Lecturer program from 1.10.2019 and in the first batch three persons were selected from India viz Mr. Krishnan Viswanath, Mr. Vikram Murthy & Mr. K.K. Mitra from Ashrae India Chapter. Ashrae India Chapter has created history in January 2020 when three new chapters were installed at Kolkata, Chandigarh, Jaipur by Dr. Ahmed Alaa – DRC. First time in Ashrae history 3 new chapters were installed in one month. We had the privilege to host the Ashrae President Mr. Darryl K Boyce, Mr. Jeff Littleton- Executive Vice President, Ms. Vanita Gupta – Director Marketing, Ms. Erin McGee – Marketing Coordinator and Ms. Francine Boyce. A facilitation was held for the visitors where Past Presidents of AIC & BOG Members were present. Mr. Darryl K Boyce and Mr. Jeff Littleton had visited a Student Chapters, Training Institute and a Government office.

Ashrae President also had an interaction with Presidents of all Ashrae Chapters in India, Past Presidents of various chapters & senior members of various Ashrae Chapters and Sri Lanka. ASHRAE Meeting held on 28th Feb., 2020 during ACREX at Venue. Ashrae had organized several programs in the memory of Lt. Dr. Prem C. Jain founder of Ashrae India Chapter viz Painting competition for Students, Health Check up camp for Students and a Cricket Tournament. Recently Ashrae have declared a scholarship in the name of Lt. Dr. Prem C. Jain for the students of developing countries. Further in the coming three months of the present society year, we have planned several programs.

A BIM workshop was held on 07th Nov., 2019 at DAV University student branch at Jalandhar. The speakers of BIM Workshop were Mr. Nazim Khan, BIM Evangelist – MEP, Capricot Technologies Pvt. Ltd. The workshop was very well attended and appreciated by the participants. Participation certificate was distributed to the students.



Mr. K.K. Mitra, Ashrae RAL Regional Lecturer gave an expert talk on the topic "Thermal Insulation System for Energy Efficient Green Buildings" Organized by ASHRAE India Chapter at Chandigarh Group of Colleges & Technical Campus, Jhanjari, Chandigarh held on 13.11.2019.



ASHRAE Distinguished Lecturer Mr. Frank Mills gave an expert talk on the Topic "Net Zero Hospitals" Organized by the ASHRAE India Chapter, Ashrae Jaipur section held on 16th November-2019. The program was widely published in local newspaper.



स्टूडेंट्स ने जानी नेट जीरो एनर्जी बिल्डिंग्स की महत्ता

जायपुर क्लस। पूर्णिमा यूनिवर्सिटी में अमेरिकन सोसायटी ऑफ हीटिंग, रेफ्रिजरेटिंग एंड एयरकंडीशनिंग इंजीनियर्स (अशरे) की ओर से 'नेट जीरो बिल्डिंग्स' विषय पर टेक्निकल टॉक आयोजित की गई। इसमें यूके की फ्रैंक मिल्स कंसल्टिंग के प्रेसीडेंट फ्रैंक मिल्स ने स्टूडेंट्स को नेट जीरो बिल्डिंग्स की महत्ता समझाई। अंत में मैकेनिकल डिपार्टमेंट के एचओडी डॉ. जयंत किशोर पुरोहित द्वारा धन्यवाद ज्ञापित किया गया।



During the Ashrae meeting held at Atlanta H.Q. in November 2019, three new chapters formation proposal was discussed. Ashrae approved the formation of following three chapters :-

- East India Chapter, Kolkata
- Ashrae Chandigarh Chapter, Chandigarh

c. Ashrae Rajasthan Chapter, Jaipur

A history was going to happen in the month of January 2020 when three new chapters were to be installed, the first time three chapters being installed in a month.

AIC TECH 2019 Conference

ASHRAE India Chapter organised 7th Edition of its flagship Annual International Conference "AIC TECH 2019" on 15th Nov., 2019 at Aviation Academy of India, New Delhi. The Conference theme was titled "Sustainability in Practice – Building Sustainable Hotels".

a. The program inaugural was done by Mr. K. K. Mitra, Chair CTTC followed by inaugural address by Dr. Varun Jain - President, Ashrae India Chapter. The program chief Guest was Shri Anand Kumar - Secretary, MNRE

b. The Key Note address was delivered by Mr. Vikram Choubal – Vice President (Project Management), Marriot International South Asia.

c. The lamp lighting was done by senior AIC members – Mr. G.C. Modgil, Mr. Uma Shankar Garg, Mr. Kapil N. Mehrotra along with Chief Guest Mr. Anand Kumar and Dr. Varun Jain.

d. There were eight technical presentations by Mr. Dharmendra Rathore - Founder & CEO IoTomation Ecotech Pvt. Ltd., Mr. Frank Mills - C.Eng., Frank Mills Consulting. Mr. K D Singh - Managing Director, AIRCON ENGINEERS (P) LTD. Pankaj Dharkar - Founder & President, Pankaj Dharkar & Associates (PDA). Mr. Rajaraja Menon – Director, Arcop Associates P.L. Mr. Sanjay Batra - Project Director, MEDANTA HOSPITALS. Sunil Shahani -

Director – MEP Operations, AECOM India Pvt. Ltd. Vikram Choubal - Vice President at Marriott International, Mumbai. There was a vibrating panel discussion on Net Zero Hotels moderated by Mr. Pankaj Dharkar – President, Pankaj Dharkar & Asso. The panelist were Mr. Sanjay Batra, Mr. G.C. Modgil, Mr. Sandeep Goel, DL Mr. Frank Mills, Mr. Rishi Pawah, Asst Vice President, Property Management, Gurgaon, Capital Land India.

The conference was a great success with participation from over 200 delegates. The delegates included Industry experts, stakeholders in hotels, Chief Engineers and Project manager of Hotels, top decision makers from various user organizations, leading Consulting firms, key persons from the Government and public enterprises, contractors, manufacturers etc.



ASHRAE DL Mr. Daniel H. Nail visited Delhi in November 2019 and delivered a lecture titled “Energy Efficient HVAC Strategies” on 18.11.2019 at Jamia Millia Islamia College of Engineering, Delhi. Subsequent to the presentation he had interactions with the engineering students from Mechanical and Air Conditioning branch as well as Post Graduate students. The inaugural address was given by Mr. K.K. Mitra, Chair CTC.



BIM Workshop was held at UPES University student branch at Dehradun on 22nd Nov, 2019 Student. The speakers at the workshop were Mr. Nazim Khan, BIM Evangelist – MEP, Capricot Technologies Pvt. Ltd. The workshop was very well attended and appreciated by the participants.



A distinguished Lecture Programme was held on 9th Dec., 2019 at Jaipur Club Ltd, Jacob Road, opp. P.W.D. Office, Jaipur. The Programme was attended by 50 participants. Dr. Kishor Khankari Presented lecture on Design and analysis of Natural ventilation systems. The event was appreciated by the participants and well attended.



Department of Mechanical Engineering, Poornima College of Engineering, ASHRAE Jaipur Section Organized a Technical Talk by Dr. Kishor Khankari on Design and analysis of Natural ventilation systems on 10th December, 2019



AIC organized its BOG meeting at Kolkata on 7th December, 2019 at Raaj Kutir, Sawbhum, Kolkata – the venue of reckoned concurrence. The meeting was attended by AIC BOG, proposed BOG of incoming Kolkata Chapter – Mr. Nitin Naik-SR II, Sudip Nath - Treasurer. and other senior members of AIC and other chapters. A brief orientation program was done by Mr. Aakash Patel – ARVC (RP) & Mr. Priyank Garg – Chair GGAC, AIC. The program was also attended by AIC office executive Ms. Indrani Rawat & Mr. Ranjit Ashrar.



A distinguished Lecture Programme was held on 11th Dec., 2019 at Magnolia, India Habitat Centre, Lodhi Road, New Delhi. The Programme was attended by 47 participants. The program was inaugurated by Mr. K.K. Mitra – Chair CTC, AIC. Dr. Kishor Khankari Presented lecture on 'Application of Computational Fluid Dynamics (CFD) for Built Environment' Key Note Address by: Mr. Ashish Rakheja informed the audience present the benefits of ASHRAE. The partners for the event were Mechartes Researchers Private Limited. The event was appreciated by the participants and well attended.



Government advocacy program was done at Goa on 13.1.2020. Standard 188 handed over to Dy. Chief Minister of Goa. The event was attended by all Ashrae Chapters of India. From AIC Mr. G.C. Modgil, RVC, GGAC and Chair GGAC attended the program.



Installation ceremony of East India Chapter, Kolkata was held on 15.1.2020 at The Sonnet hotel, Kolkata. Technical talk was given by Mr. Krishnan, Member Ashrae Technical Committee and nominating Committee Member Ashrae RAL. Dr. Ahmed Alaa-DRC, Ashrae RAL conducted oath ceremony. Other dignitaries present were Mr. Osama Khayata (RCC & Web Master), Mr. Nitin Naik – SR-II, Mr. Richie Mittal – RMCR, Mr. Ashok Virmani-Past DRC and members of AIC Mr. K.K. Mitra, Mr. Abid Hussain, Mr. G.C. Modgil, Ms. Indrani Rawat & Mr. Ranjit Ashrar.

East India Chapter Kolkata team is lead by Mr. Manoj Chakravorti-President, Mr. Dipak Barma – President (Elect.), Mr. Vishal Kapur – Vice President, Mr. B.B. Singh – Secretary. The program was supported by Aircon Engineers Pvt. Ltd. as partner.



Ashrae India Chapter organized an annual event 'ASHRAE NIGHT' on December 20, 2019 evening at India Habitat Centre, Lodhi Road, New Delhi. Members attended Ashrae night along with spouse & children and had enjoyed the evening, which was full of entertainment, games along with music and orchestra performed by eminent Mr. Sanjay Pradhan and Ms. Sayra Khan. Senior AIC members viz Mr. Nand Mehra, Mr. Virendra Wadhwa, Dr. Sumat Jain, Mr. Ravish Khosla. were facilitated by Past and Present AIC Presidents and senior members. Members promotion drive was also carried out by RP Mr. Rajesh Jain inviting contribution from participants. Some new members were enrolled. A gala time participated in various events and won prizes. There were also lucky draws and prizes were distributed to the winners. The event was supported by K-flex India Pvt. Ltd. and Aircon Engineers Pvt. Ltd. The partners were also solicited.



Installation ceremony of Ashrae Chandigarh Chapter was held on 18.1.2020 at hotel Altius, Chandigarh. Dr. Ahmed Alaa – DRC, RAL Ashrae conducted both ceremony in the presence of Mr. Osama Khayata, Mr. Nitin Naik, Mr. Richie Mittal, Mr. Sayani Haribabu – RAL(Treasurer), Mr. Ashish Rakheja-Director-at- Large & AIC BOG members Dr. Varun Jain, Mr. G.C. Modgil, Mr. K.K. Mitra, Mr. Priyank Garg, Mr. Abid Hussain, Mr. Kanagaraj Ganesan, Ms. Indrani Rawat & Mr. Ranjit Ashrar. Ashrae Chandigarh team is led by Mr. Amardeep Singh – President, Mr. Pankaj Sareen-Vice President, Mr. Money Khanna-Secretary, Mukul Grover - President Elect, Vijay Kumar Sharma - Treasurer. Mr. K.K. Mitra – RAL Regional Lecturer gave an expert talk on “Thermal Insulation System for Energy Efficient Green Buildings”, Mr. Ashish Rakheja, Director - at – Large ASHRAE presented on Motivational Address & Way Forward in ASHRAE., Mr. Priyank Garg, GGAC Chair, ASHRAE India Chapter on Address on ASHRAE Chapter Functioning.



Ashrae Rajasthan Chapter Jaipur installation program was held on 20/1/2020 at hotel Four Points by Sheraton, Jaipur. Dr. Ahmed Alaa – DRC, RAL Ashrae attended the ceremony in the presence of Mr. Osama Khayata, Mr. Nitin Naik, Mr. Sayani Haribabu – ARVP, Treasurer, AIC BOG members and Dr. Varun Jain, Mr. K.K. Mitra, Mr. Abid Hussain, Mr. Kanagaraj Ganesan, Mr. Dharmendra Rathore, Mr. Ashok Virmani, Ms. Indrani Rawat & Mr. Ranjit Ashrar. Ashrae Rajasthan team will be led by Mr. Rishabh Kasliwal – President, Mr. R S Saxena - President - Elect, Mr. Shailendra Kasera-Vice President, Mr. Amit Kakkar - Secretary Ashrae Rajasthan Chapter solicited AIC members.



FELLOWS

In the winter conference of Ashrae at Atlanta, three fellows from India were selected viz – Mr. G.C. Modgil, Mr. Uma Shankar Garg & Mr. Shailesh Phatak. Ashrae India Chapter congratulates the members and feel very proud that out of the three selected fellows two are from Ashrae India Chapter.



18. HaritPrem Bharat Mahotsav was celebrated by the chapter from January 23 to 29, 2020. The following event were held by the chapter.

- o Painting competition on Green Sustainability held on 23th Jan., 2020 at Raisina Bengali School, C R Park, New Delhi. 313 students participated in the competition. The students were from Class-1 to Class-3. Various prizes were distributed at the end of the competition to the winners.



Health check up camp was organized on 24th Jan., 2020 at Hira Lal Jain Sr. Secondary School, Sadar Bazar - the school where Lt. Dr. Prem C. Jain was a student. The health check up camp was conducted by Dr. Indra Taneja – M.D, FAAP, IAP (wife of Dr. Om Taneja - Ashrae Fellow and Member AIC). Incidentally Dr. Om Taneja is also a student of Hira Lal Jain school. 100. nos. students basic health check up was done and reports were shared with school authorities.



Ashrae India Chapter organized the first Dr. Prem C. Jain Memorial Cricket Tournament on 25.1.2020 at PGDAV College, Ring Road, Nehru Nagar, New Delhi-110065. Daikin sponsored the event.

AIC Senior members Mr. Ashok Virmani, Mr. Ashish Rakheja, Mr. Sunil Kher & BOG members Mr. Rajinder Singh, Mr. K.K. Mitra, Mr. Kanagaraj Ganesan, Mr. Kunal Chaudhari, Ms. Arundhati Singh Khanna, Ms. Indrani Rawat & Mr. Ranjit Ashrar were present. Ms. Payal Jain grace the occasion. She was the initiator of this event. Mr. Kanwaljit Jawa – M.D, Daikin inaugurated the tournament by playing first ball. Other members present from Daikin were Mr. Anubhav Acharya-Managing Director's Office & Gaurav Bakshi- AGM- Branch Operations Head. The tournament was attended by 8 nos. Ashrae student chapters. The finalist were Pusa Institute and Amity University. The tournament was won by Pusa Institute. Prizes were distributed to the Winner, Runners up, Best bowler, Best Batsman and man of the match. A medal was provided to all participating players. Ball to ball commentary was provided by Ms. Indrani Rawat.



Mr. Rajesh Jain, BOG Member presented a Technical Paper on Specifics of Modern Tunnel Ventilation System in Delhi Mass Rapid Transit System on 4th Feb. at Ashrae Winter Conference, Orlando



Ashrae India Chapter participated in Hi Aim Conference cum Exhibition on 6-7 February, 2020 at Radisson Blu Plaza, Mahipalpur, New Delhi. Dr. Varun Jain – President, AIC and Mr. K.D. Singh – AIC BOG Member made presentations during the conference. Membership promotion drive was also carried out.



ASHRAE President Visit to India Program details

Ashrae President Mr. Darryl K Boyce along with Mr. Jeff Littleton- Executive Vice President, Ms. Vanita Gupta – Director Marketing, Ms. Erin McGee – Marketing Coordinator and Ms. Francine Boyce visited Delhi from 24th – 29th February, 2020. AIC had the opportunity to host the visitors and has planned several programs.

On 25th February, 1st program was to AIC Student Chapter at Maharaja Agrasen Institute of Technology, Delhi. A half day symposium was organized to Student Chapter. Mr. Darryl K Boyce addressed the students. Two technical presentations were given by Mr. K.K. Mitra – RAL Regional Lecturer and Mr. Rajinder Singh – Chair Student Chapter. Presentations were also made by Professors of the Institute. Mr. Darryl K Boyce and Mr. Jeff Littleton were welcomed in traditional Indian attire and solicited. Event was attended by more than 500 students of department. There was also an interaction with the students.



Mr. K.K. Mitra – Ashrae RAL Regional Lecturer was invited by Bangalore Chapter for providing two lectures. He gave an expert talk on the topic “Thermal Insulation System for Energy Efficient Green Buildings” at REVA University Student Chapter on 7th February. An expert talk was also provided on the topic “Modern and Energy Efficient Cold Storage construction with Thermal Insulation System” to the members of ASHRAE & ISHRAE Bangalore Chapter.



In the evening of 25th Feb, 2020, President had interactive with AIC members and Past Presidents. The program was attended by Ashrae President Mr. Darryl K Boyce, Mr. Jeff Littleton- Executive Vice President, Ms. Vanita Gupta – Director Marketing, Ms. Erin McGee – Marketing Coordinator and Ms. Francine Boyce. AIC members attended the program along with spouse. It was a very nice evening with informal interactions by the participants. Everyone spoke about their involvement in ASHRAE and how they look the future. The visitors were solicited with traditional Indian Souvenirs by AIC members and their spouse. This evening AIC President along with Ashrae President Mr. Darryl K Boyce solicited the newly selected fellows from AIC Mr. G.C. Modgil and Mr. Uma Shankar Garg. The spouses also had a wonderful time having interactions with Ashrae visitors and among themselves.



On 26th February morning, Ashrae President Mr. Darryl K Boyce, Mr. Jeff Littleton- Executive Vice President were taken to School of Planning & Architecture at Delhi where a new student chapter is going to be formed shortly by the name Dr. Prem C Jain Ashrae Student Chapter. Professor Virender Paul took the initiative and lead in organizing the program. Ashrae President Mr. Darryl K Boyce, Mr. Jeff Littleton- Executive Vice President addressed the students and faculty. Mr. Ashish Rakheja – Director, Ashrae and AIC members Mr. Sandip Goel, Mr. K.K. Mitra also addressed the students. Other AIC members Mr. Abid Hussian, Mr. Kanagraj Ganeshan & Mr. Rajinder Singh – Chair Student Chapter also attended the program.



In the afternoon on 26th February, 2020 Ashrae President Mr. Darryl K Boyce, Mr. Jeff Littleton- Executive Vice President visited Building & Services Institute at Okhla Industrial Area, Phase-II, New Delhi-110020, who conducts specific training programs on air conditioning system to students. The purpose and objective of the institute was presented to the visitors and also how Ashrae can collaborate with the institute in future. Detailed deliberations were exchanged. The visit was also attended by Dr. Sumat Jain. Ashrae Life Member, Mr. Ashok Virmani – Past DRC; Mr. G.C. Modgil - Fellow, Mr. Sunil Kher – Past President.

AIC BOG members led by Dr. Varun Jain - President, Mr. Dhamendra Rathore- President (Elect.), Mr. K.K. Mitra-Chair CTTC, Mr. Sandeep Goel, Mr. K.D. Singh. Ms. Priyanka Jain – Director of the Institute coordinated the visit



From 27th – 29th February, Ashrae visitors participated in ACREX Exhibition cum Conference held at India Exposition Mart, Greater Noida. ACREX is a flagship event of ISHRAE supported by ASHRAE and is one of the biggest event in South East Asia. Ashrae President Mr. Darryl K Boyce participated in the inauguration program and watered the environment cleaning plants. The theme of ACREX ACR was SHUDH VAYU DEERGH AAYU. Green plantation needs to purify the environment.



On 28th February morning an Ashrae meeting was organized between Ashrae President Mr. Darryl K Boyce, Mr. Jeff Littleton – Executive Vice President and with all Chapter Presidents, which is usually done every year during ACREX. A meeting was organized by Mr. Nitin Naik, SR-II and participants were Presidents from Ashrae India Chapter-Mumbai, Pune Chennai, Hyderabad, Kolkata, Chandigarh & Jaipur. Other participants were senior members Mr. Ashok Virmani, Mr. G.C. Modgil, Mr. Vikram Murthy, Mr. C. Subramaniam and the complete AIC BOG led by Dr. Varun Jain along with Mr. K.K. Mitra, Mr. Priyank Garg, Mr. Abid Hussain, Mr. Kanagraj Ganeshan. Other AIC members were Mr. Sayani Haribabu, Ms. Indrani Rawat, Mr. Ranjit Ashrar.



On 27th February Ashrae President Mr. Darryl K Boyce, Mr. Jeff Littleton- Executive Vice President along with AIC members Dr. Varun Jain, Mr. Dharmendra Rathore, Mr. K.K. Mitra, Mr. Abid Hussain, Mr. Priyank Garg visited the Ministry of Electronics & Information Technology at Electronics Niketan, 6 CGO Complex, Lodhi Road, New Delhi for having interaction with Mr AK Garg, Director. The objective of the meeting was to discuss about the upcoming 3rd Developing Economy Conference and AICTECH International Conference in March 2021 where theme would be on Digitalization and ASHRAE is planning to involve Government machinery for this mega event. Mr AK Garg expressed his desire to work with Ashrae. A suitable document of partnership will be soon generated by Ashrae.



- Ashrae USA has declared a news scholarship in the name of Lt. Dr. Prem C Jain. The scholarship is titled PREM JAIN SCHOLARSHIP This scholarship is to be given to a student from developing economies. Ashrae President during his address to the Chapter Presidents and also during visit to other Student Chapter made the announcement of this scholarship.
- This year Maharaja Agrasen Institute of Technology has won three scholarship viz
 - "Design and Development of Cascade Refrigeration Systems for Low Temperature Application as a Training and Demonstration Unit".
 - "Design and Development of Vapor Compression Experimental Test Rig Using Ejector as an Expansion Device".
 - "Design and Development of House Hold Refrigeration System Assisted With two Phase Ejector"
- 2 New Students Chapters - Galgotia University, Greater Noida and Tulas Institute, Dehradun were enrolled. Also enrolled 126 no. new members.
- Mr. Ashish Rakheja announced to the Ashrae President that 3rd Developing Economy conference would be organized by Ashrae India Chapter, which would be held in March 2021.
- ASHRAE declares COVID 19 measures.
Ashrae advises all Members, Staff and their Family Members to take Precautions during ongoing COVID 19 Pandemic Spread, to maintain Social distancing and work from home. To avoid travel till 30th July. Ashrae wishes good Health Stay Safe to everyone.

Zirakpur Case Study

Money Khanna



10.5 Case Study 5: Mehara Hospital, Zirakpur, Punjab

10.5.1 General Information

- Location: Zirakpur, Punjab
- Climate Zone: Composite
- Building Type: Hospital
- Occupancy Hours: 24 Hours
- Building Area: 7060 m²
- Connected Load: 400 kVA
- Compliance Approach: Whole building performance

10.5.2 Building Description:

Mehara Hospital, Zirakpur is Multi-speciality hospital in Singhpura, Zirakpur. The building comes under Municipal Council Zirakpur. The hospital has Basement + Ground+3 Floors. The total built up area of the project is around 7060 m².

10.5.3 Building Envelope:



Fig. 10.5.1 Construction phase image

10.5.3.1 Window wall ratio

The project has designed minimum fenestration but enough to get adequate day light and proper ventilation. Overall Window Wall Ratio is comes out to be 6.38%. The building has also used

Opaque Assembly	Construction Layers	Specification
Ext. WALL Assembly	Assembly layers: Innermost – 12 mm Plaster + 230 mm Blocks AAC Blocks + 12 mm Plaster	U-value, W/m ² K: 0.62 W/m ² K Assembly thickness, mm: 254 mm
Wall insulation	Type: No Insulation	R-value, K m ² /W: Thickness, mm:
Roof Assembly	Assembly layers: Cement Screed 100mm RCC + 85 mm PUFF insulation + 50 mm Cement Screed	U-value, W/m ² K: 0.24 Assembly thickness, mm: 235 mm
Roof insulation	Type: PUFF Insulation	R-value, K m ² /W: 3.7 Thickness: 85 mm

Table 10.5.1 Roof and wall assembly

overhangs over windows in some directions and some sections of the building.

Facade	AREA, m ²	Opaque wall area, m ²	Glazed area, m ²	WWR
East	676.54	650	26.54	4.08
West	557	530.7	26.35	4.7
North	1032.4	967.1	65.32	6.3
South	1053.7	959.6	94.5	8.96

Table 10.5.2 Window to wall ratio

10.5.3.2 Glazing Design

Glazing Assembly	Specification	Incremental cost (compared to BAU)
Glazing type 1	Assembly layers: 6mm toughened glass 12 mm air gap 6mm toughened glass U-value, W/m ² K: 1.6 SHGC: 0.23 VLT: 39%	240 Rs/m ²

Table 10.5.3 Glazing Properties

10.5.4 HVAC Design :

The project team has installed 3 Chillers, 2 working and 1 standby. The project team has installed Fan Coil units in addition to AHU systems.

Equipment type	Baseline		Proposed	
Chiller	COP: 4.7	IPLV: 5.49	COP: 4.84	IPLV: 9.1
Split AC	BEE star rating- 3 Star		BEE star rating – 5 Star	

Table 10.5.4 HVAC parameters

10.5.5 Lighting Design :

10.5.5.1 Automatic Controls :

The project team has installed Occupancy sensors in areas like corridors, toilets, treatment rooms, and conference rooms and Astronomical time switch is provided for exterior lighting.

10.5.6 Energy Consumption Analysis

	Baseline Energy Consumption (kWh)	Proposed Energy Consumption (kWh)	Energy Savings (%)
Space Cooling	3,67,000	3,67,300	0
Interior Lighting	2,10,000	1,08,320	48.41%
Misc. Equip	2,42,900	24,2,900	0
Fans	2,92,200	2,92,200	0
Pumps	80,000	80,000	0
Heat Rejection	25,300	25,300	0
Hot Water	1,69,900	1,69,900	0
Total	13,87,825	13,31,800	4.03%

Table 10.5.5 Energy Savings

10.5.5.2 Lighting power density

The project team has used LED lights in all building. LPD of less than 8.56 W/m² will be maintained in the building.

Electrical Transformer

BEE 5-star rated transformers will be installed to maintain the maximum power losses as per table 8.1 at 50% and 100% loading.

10.5.5.3 Metering and monitoring

The project will install smart meters that can display kVA, kWh, PF, current, voltage, THD. The real time readings can be saved on cloud server.

10.5.5.4 Power factor correction

Automatic Power Factor Corrector (APFC) will be integrated with the transformer to maintain the power factor close to unity.

10.5.5.5 Power distribution system

Project will install cables of adequate size to maintain the internal power distribution losses at max 1%.

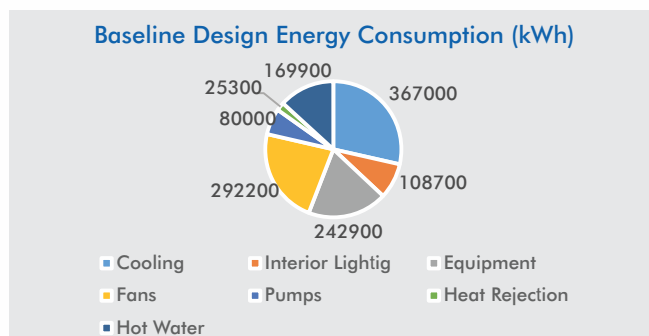


Fig. 10.5.2 Graphical representation of Baseline energy consumption

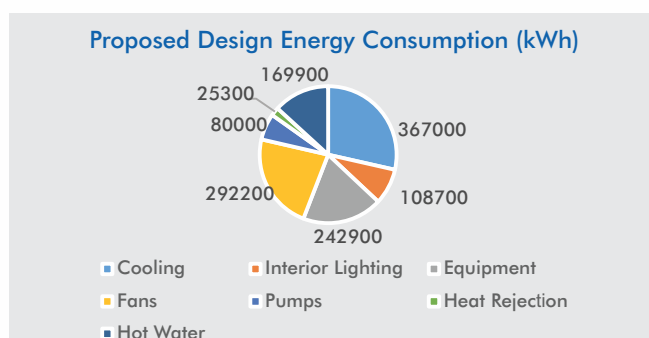


Fig. 10.5.3 Graphical representation of Proposed energy consumption

Three Tier Tunnel Ventilation System

Mr. Rajesh Jain



1.0 INTRODUCTION

During different phases of construction of Delhi MRTS project, the typical length of an underground station box was around 265 meter for 6 car train which has platform length of 140 meter. The Ashram UG station of Line-7 was also originally planned with 266 meter length and with a depth of 20.7 meter. Later, due to problems faced in land acquisition it was desired to construct the station within the length of 151 meter with the same depth of the station.

DMRC had never designed the station in such short station box length of 151 meter. This was not enough to house all the TVS equipment in a typical arrangement which was being followed at other stations.

This article presents details of unique three tier tunnel ventilation system planned at Ashram UG station on Line-7 of Delhi MRTS Phase-III. The results of Tunnel air flow achieved during testing and commissioning of the system are also included.

2.0 TUNNEL VENTILATION SYSTEM (TVS)

The TVS is provided for the Normal, Congested and Emergency Operations. During **Normal Operation** the main source of ventilation for the tunnels is piston-generated airflow produced by moving trains. The maximum and average velocity allowed at platform and concourse is 5 m/s and 3 m/s respectively during normal operation. In **Congested Operation**, the Tunnel Ventilation Fans (TVF) are activated for preventing the accumulation of warm tunnel air around idling trains in the affected ventilation zone. During congestion, the objective is to control the temperature inlet to train condenser unit below 50°C. In **Emergency Operation**, the TVS would be set to operate to control the movement of smoke and provide a smoke free path for evacuation of the passengers and for the firefighting purposes.

At a typical UG station of Delhi Metro, the TVS plantrooms are provided at both end of the station. The TVS rooms are either provided at the concourse level or at the platform level along with their entire assembly which is having fire rating of 250°C for two hours.

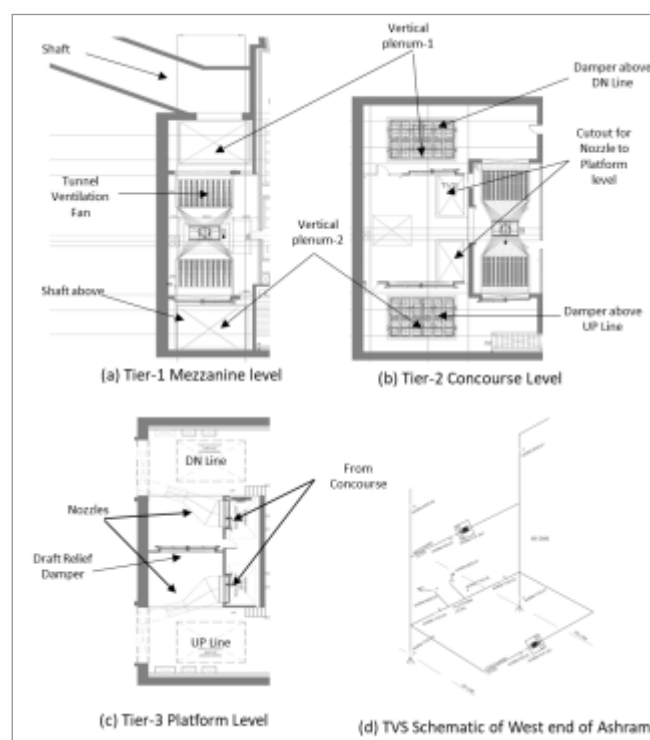
The TVS room houses (a) Two number of reversible TVFs to supply/extract air or smoke from the tunnel, (b) Sound Attenuators to reduce the noise generated by the TVF, (c) Tunnel Ventilation Dampers (TVDs) to direct the airflow in the desired direction, (d) Tunnel Ventilation Nozzles to provide the sufficient thrust to the air in the tunnel and (e) associated duct work.

The TVFs are placed longitudinally with respect to the station and the draft relief and the exhaust plenums are horizontal at the same

level. The draft relief plenum is connected to the outside ambient with a tunnel ventilation shaft at each end of the station. Typically, the TVS plant room occupies a length of approximately 37 meter on each side of the station platform.

2.1 Layout of Three Tier Tunnel Ventilation layout at Ashram station

The layout of three tier tunnel ventilation system of Ashram underground station as per general arrangement shown in below figure. In the adopted three tier arrangement, TVFs are placed across the station box instead of longitudinally direction.



Layout of 3-tier TVS at Ashram UG station and Air flow schematic of TVS

One TVF is provided at first level i.e. mezzanine level and the other TVF is provided at concourse level i.e. second level. Both fans are connected through vertical plenums on both the sides. Therefore, both the fans act as a standby to each other. The vertical plenums are connected to the tunnel ventilation shafts for supply/exhaust of air or smoke.

The concourse level, also has horizontally placed tunnel ventilation dampers over the UP and down line tracks which are used during the extraction and also acts as draft relief dampers during normal operation. The horizontal air plenum along with vertical dampers, is also provided which has the cutouts on the concourse floor slab to supply/extract the air/smoke to/from the platform level.

The third level i.e. platform level, has the tunnel ventilation nozzles which are used to supply the air to UP and Down line. There is another horizontal plenum through which, the air coming from concourse can be supplied to any of the tunnels.

The tunnel ventilation nozzles along with the air plenum at the platform level, are accommodated in 8 meter length on each side of platform, therefore a total of 16 meter space is occupied beyond the platform length of 135 meter which made it possible to have station box length of 151 meter.

3.0 TESTING AND COMMISSIONING RESULTS

The 3-tier arrangement used at Ashram UG station was for the first time in Delhi Metro and perhaps also, in any other metro in the world. Despite of all the precautions taken during design stage, there was always a dread about the actual field results.

The commissioning data were evaluated from the Subway Environment Simulation (SES), which provides the set of acceptance criteria for the overall performance of the TVS with no real fire and

in the absence of trains inside the underground corridor. If the measured airflow is more than the commissioning data given by SES then it is considered that the TVS will achieve the desired airflow for congestion mode operation and will meet the critical velocity criteria during emergency. The results achieved during actual testing and commissioning of 3-tier system is shown in table below.

4.0 CONCLUSION

The successful implementation of unique 3-tier TVS made it possible to construct the Ashram UG station with in the station box length of 151 meter (495 feet). The corridor was opened for public on December' 2018 and the station is designated smallest UG metro station in India in terms of length of station box. The results obtained with the commissioning were satisfactory and paved the great confidence in the design and execution team of Delhi Metro.

The various other initiatives taken at Ashram Station provided the way to reduce the length of station box for UG stations of Phase-IV of Delhi MRTS.

Table - Results of Tunnel Air Velocity Commissioning Testing

Tunnel section and airflow direction	Airflow acceptance Criteria as per SES		Actual Airflow achieved	
	Measured Tunnel	Airflow m ³ /s	Measured tunnel	Air flow in direction of train m ³ /s
VNPR --> ASHM	Down & Up Line	78	Down Line	91.8
			Up Line	94.3
VNPR <-- ASHM	Down & Up Line	83	Down Line	89.9
			Up Line	96.5
ASHM --> HNKM	Down & Up Line	78	Down Line	104.4
			Up Line	122.7
ASHM <-- HNKM	Down & Up Line	83	Down Line	113.7
			Up Line	94.9



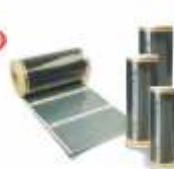
Duct Heaters



Hot Air Blower



BMS Compatible
Duct Control Panel



Heating Film



Heat Tracer



Axial Flow Fans