

Vertical Transportation Design Deliverance to Iconic Buildings

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Abstract. *Objective:* "Delivering safe, healthy and sustainable built environment buildings that perform" comprehensively captures the essence of a highly efficient building. This paper showcases, from a vertical transportation point of view, one of the most prominent projects in India – 'Central Vista' – located in the heart of the national capital, which is a modern centre of national governance.

Methodology: In any VIP building, the horizontal and vertical transportation environment becomes increasingly more important and needs to be designed in the most efficient and effective way to ensure the right balance.

Main results: In this context, the paper addresses opportunities to apply new state of art technologies within a multi-disciplinary and multi-cultural environment to improve the efficiency and effectiveness of the building. The planning is done with scope for future expansion, exploring the new built typologies.

Conclusions: This paper finally provides a comprehensive outlook on presenting an in-depth analysis of state-of-the-art methodologies deployed for safe and smooth vertical transportation in terms of passenger comfort, code compliant, energy-efficient products, sustainable maintenance procedures, IoT deployment to maximise the built potential and yet be modern and Iconic.

1 BIRTH OF THE CENTRAL VISTA

During the colonial era, leading British architects Edwin Lutyens and Herbert Baker envisaged the Central Vista complex as the centre of administration in India to house all facilities needed for the efficient functioning of the Government. It was inaugurated in 1931 and comprised the buildings, Rashtrapati Bhawan, Parliament House, North and South Blocks and the Record Office (later named The National Archives), along with the India Gate monument and the civic gardens on either side of the Rajpath. The plan was designed using traditional urban planning instruments, featuring a strong axis, an emphasised focal point, the formation of important nodes, and a definitive termination point. At the time, it was one of the largest projects of its kind in the world, conceived and designed to reflect the spirit, progress and global importance of India.



Figure 1 Architect Herbert Baker



Figure 2 Architect Edwin Lutyens

Indian influences marked the overall design of the Central Vista. It comprised the use of red and beige sandstone, which had been used for the monumental architecture of Delhi since the 13th century; the modelling of the dome of Viceroy's House on the Great Stupa at Sanchi; ancient Indian bell capitals for the Pillars of Dominion placed between the Secretariat Blocks; and countless features of Indian architecture – jalis (pierced stone screens), chhajas (projecting overhangs), chhatris (pillared cupolas), and more.

1.1 Rashtrapati Bhavan - The Emblem of the World's Largest Democracy

The Rashtrapati Bhavan, home to the President of the world's largest democracy, epitomizes India's strength, its democratic traditions and secular character. Lutyens and Baker conceptualized the H-shaped building, covering an area of 5 acres on a 330-acre estate. It has a total of 340 rooms spread over four floors, 2.5 kilometres of corridors and 190 acres of garden area. Joint efforts of thousands of labourers including masons, carpenters, artists, carvers, and cutters saw the completion of this masterwork in the year 1929. Originally built as the residence of the Viceroy of India, Viceroy's House as it was then called, has metamorphosed into today's Rashtrapati Bhavan. It is emblematic of Indian democracy and its secular, plural and inclusive traditions.

1.2 The Parliament Building - Icon of India's Democratic Ethos

A 93-year-old Heritage-I grade building, functioning as the legislative and parliamentary hub for one of the world's biggest democracies. An icon of India's democratic spirit, the Parliament Building sits at the heart of the Central Vista and houses the Rajya Sabha (Council of States) and Lok Sabha (House of the People) in separate chambers in the Parliament Building. In 2006, the Parliament Museum was also added in the Parliament Library Building to showcase the 2,500 years of rich democratic heritage to the citizens.



Figure 3 Old Parliament Building

The Parliament building has, over the years, become an enduring symbol of India's thriving democracy and was notified as a Grade I heritage structure by the Heritage Conservation Committee in 2009.

The objective of the Central Vista Development/Redevelopment Master Plan is to improve the productivity and efficiency of administration by providing it with highly functional and purpose-designed office infrastructure. Some of the emergent governance benefits shall be as follows:

Combining all 51 Central Government Ministries in 10 Common Central Secretariat buildings will allow for easy movement of personnel, documents and goods, thereby increasing administrative efficiency. The proximity and ease of inter-departmental movement, along with flexible and modular floor plans will enable the government to function in a more efficient and productive manner.

The major increase in office spaces will offset the huge gap in present and future demand and existing availability. It will create modern workspaces with the latest technology for better productivity and efficient utilization of human resources. The infrastructure and facilities will be built at par with global standards. The redevelopment project will augment efforts towards sustainable development, with the construction of green buildings and clean transportation. Overall, the redevelopment will trigger efficiency and synergy in the Government's functioning.

The Prime Minister's Office, Residence and Vice President Residence are proposed to be built near the South Block and North Block respectively, in proximity to the Parliament and Common Central Secretariat, which would help in addressing security and logistic arrangements in a comprehensive manner, without interfering with the regular movement of traffic.

Public spaces shall be improved in the Central Vista, including the National Museum, IGNCA, reformed Central Vista Avenue, and India Gate plaza and lawns, which shall be accessible to the public. Around 80,000 sq. m. of government space in the North and South Blocks will open as public space due to their conversion to the National Museum complex.

An underpass within the Central Vista Avenue is also being constructed to ensure the road safety of people visiting the iconic spot while reducing traffic congestion.

People can reach the Central Vista Avenue through public transport or park their vehicles at the dedicated parking space made available at the site. Further, dedicated spaces for social gatherings in the refurbished avenue will provide opportunities to tourists for leisure and recreation.

1.3 Environmental Sustainability

Environmental Sustainability is at the core of the Central Vista Development/Redevelopment Master Plan, with a comprehensive approach to use centralised systems and infrastructure, promote the use of public transport and have upgradeable technology, systems and services. Strict measures are also being undertaken simultaneously to minimise the environmental effects of the Central Vista project during the construction phase. Steps are being taken to minimise on-site air emissions, noise, wastewater discharge, soil erosion as well as construction waste.

The projects will result in an overall increase in green cover. No trees will be cut in any project in the Central Vista. Trees will be transplanted in Eco-Park being developed by NTPC at Badarpur after due permission from competent authorities.



Figure 4 New Central Vista – Aerial view

2 GUIDING PRINCIPLES OF CENTRAL VISTA DEVELOPMENT/REDEVELOPMENT OF MASTER PLAN

2.1 Restoring the Original Symmetry and Layout of the Central Vista

The Central Vista was originally designed with strong underpinning geometry, splendid symmetry and a carefully choreographed processional route (axis, focal, point, nodes and termination). The Master Plan aims to restore the original symmetry and order while respecting the Heritage of the building and spaces.

2.2 Strengthening the Functioning of Legislature

The Master Plan proposes the first purpose-designed Parliament for independent India, equipped with state-of-the-art infrastructure to meet all the needs of an expanded Parliament. After the present building is retrofitted and refurbished, the two will be used in conjunction. In addition, a separate building to house the offices of Members of Parliament is also planned. The present Parliament building, Library and Annexe, along with the new Parliament Building and Chambers for Members of Parliament, will form an integrated Legislative Enclave.

2.3 Improving Productivity and Efficiency of Administration

The planned Common Central Secretariat (CCS) will include 10 office buildings and a Central Conference Centre. At present 39 Ministries are housed in the Central Vista, whereas 12 Ministries have offices outside the Central Vista. All 51 Ministries are envisioned to be located in 10 CCS buildings to improve coordination, collaboration and administrative synergies. The office spaces are being planned with modern technological features and adequate space with amenities. The present buildings of the Central Vista shall be replaced with modern office buildings with the capacity to hold about 54,000 personnel, which will meet the present and future needs of the Ministries/Departments. All these offices are planned to be connected through a loop of automated underground people-mover, over-ground shuttles and walkways. These buildings will come up through the redevelopment of existing Central Secretariat Offices like Udyog Bhawan, Nirman Bhawan, Krishi Bhawan, Shastri Bhawan, etc. located on either side of Rajpath. Further, the Defence Enclave has been planned in order to consolidate the multiple Departments and attached offices of the Ministry of Defence, including the Defence Research and Development Organisation (DRDO), Department of Defence Production and Offices of the Indian Armed Forces i.e. Indian Army, Indian Navy and Indian Air Force. Overall, the Secretariat will house modern offices, and conferencing facilities for all Ministries of the Government of India.

2.4 Conservation and Rejuvenation of Cultural and Heritage Facilities

The Central Vista Avenue will be refurbished, its infrastructure upgraded, and new social amenities will be provided, while retaining its essential character, to make it more comfortable to use and of a befitting quality, with adequate infrastructure for national events. The magnificent North and South Blocks will be refurbished to house the National Museum. They will house exhibits of 'India up to 1857' and 'India since 1857' respectively. The IGNCA will continue its important cultural agenda, at a new location opposite Hyderabad House on the Hexagon, in expanded, purpose-designed, world-class facilities. Further, a purpose-designed facility is also envisioned beside the historic building of the National Archives of India (NAI) for creating state-of-the-art facilities.

2.5 Providing Adequate and Secure Infrastructure for Executive Offices

A modern, secure and appropriately-equipped Executive Enclave is planned to house executive offices and facilities for the Prime Minister's Office, the Cabinet Secretariat and the National Security Council Secretariat. Secure residential facilities for the Vice President and the Prime Minister are planned behind the North and South Blocks, with all necessary amenities for their day-to-day functioning.

2.6 Ensuring Environmental Sustainability, Expanding Public Space and Extending the Central Vista Axis

The overall objective of works planned on the Central Vista is to ensure environmental sustainability, expand and improve public space, and to extend its axis. The New India Garden is being planned near the River Yamuna. thereby extending the present Central Vista axis by 2.24 km to realise the vision of 'Ridge to River'. Further, a publicly-accessible National Biodiversity

Arboretum is planned to the west of the President's estate, to showcase endangered plants of India in high-tech greenhouses set amidst indigenous forestation.



Figure 5 Ensuring environmental sustainability

2.7 Providing Adequate and Secure Facilities for the Vice President and the Prime Minister

Modern, adequate and secure residential facilities for the Vice President and the Prime Minister are planned to the north of North Block and south of South Block respectively. These new residential facilities will be highly functional and equipped with all the necessary amenities. Locating offices and residences of all dignitaries in a single location will reduce redundancies of infrastructure and improve city traffic management.

2.8 Promoting Transit Oriented Development

The Central Vista Development/Redevelopment project has been envisaged by integrating the principles of transit-oriented development. An Automated People Mover of approximately 3.1 km in length will be constructed underground to connect and integrate all the buildings of the Common Central Secretariat. It will run in a close loop to satisfy the transportation requirement of Government employees working in these buildings. It will provide connectivity to the existing Metro Network at Udyog Bhawan and Central Secretariat Stations at the Yellow and Purple lines of the Delhi metro which has onward connectivity to the National Capital Region (NCR) and that will reduce the need to commute to the office using private vehicles. All the buildings of the Central Secretariat will be connected to each other and to Delhi's metro network via a secure underground people mover and with the city's bus network via a grade shuttle. As a result of the uptake of shared transit facilities, overall emission and air pollution level from personal vehicles is expected to reduce, resulting in the improvement in the overall air quality of the capital city.

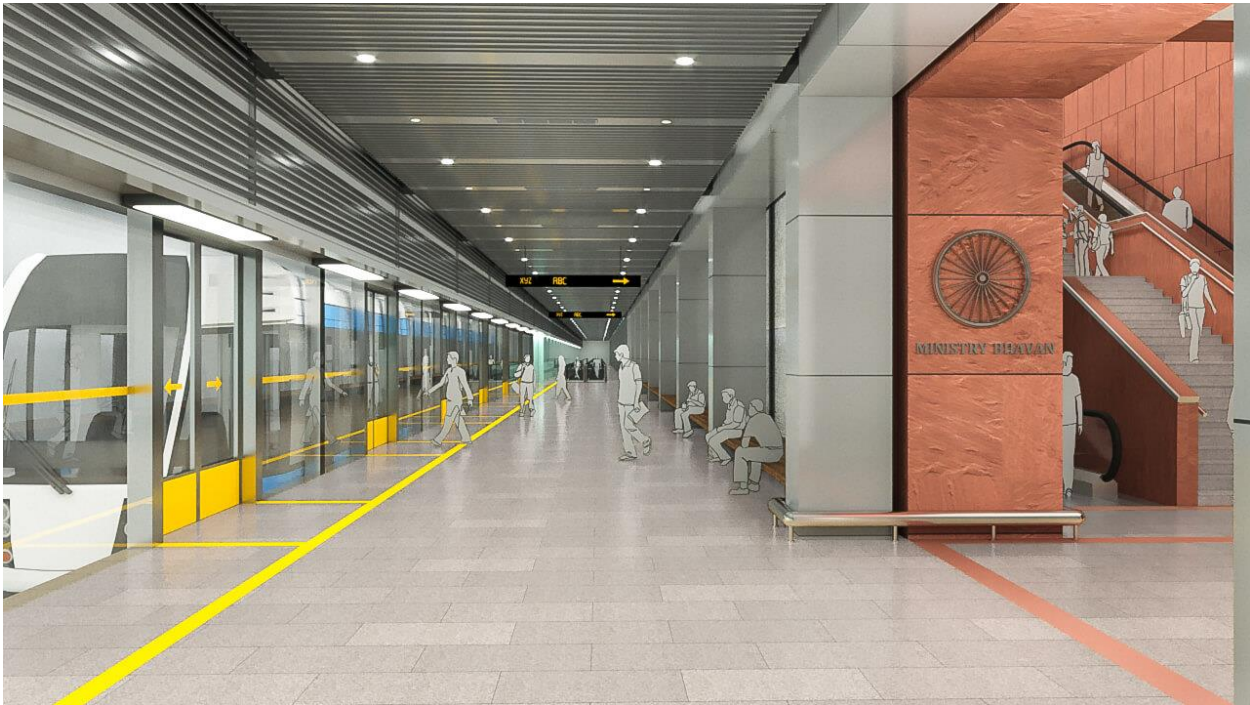


Figure 6 Transit Oriented development

3 HORIZONTAL AND VERTICAL TRANSPORTATION PLANNING -CASE STUDY - CENTRAL SECRETARIAT

Central Vista, located in the heart of the national capital, is a modern centre of national governance, consisting of new secretariat buildings located in four clusters along the Rajpath. The first Cluster of 3 Central Secretariat Buildings is a G+6 storied building with 2 basement levels connecting three individual towers and is designed to house a population of 5750 people in each tower.

3.1 Scope

This report covers input data, assumptions, design criteria for simulation and recommendations for lifts and escalators for the cluster of 3 central secretariats.

3.2 Inputs data and assumptions

- i. Area Statement and population of the building
- ii. Architectural Floor plans and sections
- iii. Lift design data:

a. Project Traffic Study Data

Name of building:	Central Secretariat
No. of floors:	2 Basements, Ground +6 floors
Occupancy type:	Office / Business
Design with or without Machine Room:	Machine Room Less (MRL)
Building construction status:	Scheme/design stage

Lifts serving terrace: No

b. Lift Floor Height Details:

	OVER HEAD	
6	4575	OFFICE
5	4575	OFFICE
4	4575	OFFICE
3	4575	OFFICE
2	4575	OFFICE
1	4575	OFFICE
G	4575	MAIN ENTRY
B1	6900	BASEMENT-1 PARKING
B2	4500	BASEMENT-2 PARKING
FLOOR		

c. Population Details for Each CS Building:

Population : 5750

Floating population (Visitors considered at 20% of population) : 1150

Total Population considered : 6900

Total users during peak : 90%

Total no. of users in peak population considered per zone (4 zones): : 6210
1553

FLOOR WISE POPULATION	
6	1000
5	1000
4	950
3	950
2	950
1	450
G	450

d. Assumptions:

Parameters	Variables
Tenancy	Multi Tenancy as Floors Would Be For Different Departments
Total Population Given	6900 - including floating population
Population Consideration For Traffic Study	90% Occupancy
Door Open Time	Variable
Door Closing Time	Variable
Passenger Entry/Exit Time	Variable
Avg. Highest Floor Reached	Variable
Avg. No. of Stops Made	Variable

e. Assessment of Peak Demand:

Parameters	Variables	Assumptions
Occupancy of the building	5750	
Staff arriving from metro	2875	Assumed 50%
Staff arriving from car	1438	Assumed 25%
Staff arriving by bus	575	Assumed 10%
Staff using APM	3163	Staff from metro & 50% from Bus are assumed using APM
Staff using basement car parks	719	50% of car park staff from basement are assumed
Total staff from basements to the ground floor	3881	

f. Arrival Rates Assumptions in Peak Hour on the Ground floor

Parameters	Variables
Staff from basements to the ground floor	3881
Staff arriving directly on the ground floor	1869
TOTAL POPULATION	5750
Consider floating population	1150
Total Population consideration	6900
90% Occupancy	6210
Population arrival per zone	1553
Peak burst arrival assumed in 5 minutes during morning up peak (Considering rapid APM arrivals)	311
Arrival rate demand% considered during peak burst arrival in morning up peak	20.0%

4 MORNING UP PEAK

- People using the metro shall use the APMs to arrive at the basement floors.
- People using their own transportation shall park on the basement floors.
- From basements, people shall reach the ground floor using escalators and basement parking lifts provided to travel from the basement floors to the ground floor. They shall then take the main passenger lifts in their respective zones to reach their destination floor.
- Main passenger lifts are not accessible in the morning hours for use. They shall be accessed from the ground floor only.
- The people arriving by other means of public transport shall directly enter the ground floor and take the main passenger lifts to their destination floor.

5 CONCEPT DESIGN RELATED INFORMATION

5.1 Passenger Lifts:

The design has 4 passenger lifts (2+2) with 4 zones of lifts in 4 corners of the building. Traffic study results are based on a per-zone basis.

5.2 Fireman's Lifts:

On all 4 corner zones of the buildings, there are 2 independent lifts per zone. These 2 lifts shall be specified/designated as Fireman's lifts but can be used as service lifts regularly.

5.3 Basement Parking Lifts

These 4 lifts (2 North wing & 2 South wing) shall be in addition to escalators.

5.4 Cafeteria Lift

This lift shall be used to carry cooked food from B1 to the ground and first-floor cafeteria.

5.5 Escalators

Escalators are provided for rapid passenger movement from basements to the ground floor.

6 BIOGRAPHICAL DETAILS

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