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Thesis Design Proposal for high-speed rail station at poonamallee, Chennai

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ABSTRACT

The Chennai to Bangalore is one of the profitable and busiest train route in India. The NHRCL identified 9 stations between Chennai to mysuru high speed rail project. Poonamallee is the second station next to the Chennai terminal. The detailed project report for the Chennai to mysuru high-speed rail project is under progress. I have selected the poonamallee location for the proposed high-speed rail station for my thesis project.

The proposed high-speed rail station at poonamallee will facilitate in and around the western suburban population of Chennai city. The commercial development revenue will provide the financial backbone for the proposed high-speed rail station development include the shopping center, multipurpose hall, office, and hotel. It is not only provides the passenger facilities and provide commercial facilities it is required for the neighborhoods. The proposed development formulated after thorough study of existing land use around station influence area. Hence, the proposed high-speed rail station and supporting commercial facilities will way forward for the successful high speed rail station model for the similar future projects proposed in India.

Keywords;

High-Speed Rail, Station influence area, Primary flow, Secondary flow.

1.0 Introduction:

The mass rapid transport is proposed in various countries to encourage the people to use the public transportation and reduce the personnel vehicle usage. The high-speed rail network connects the important cities, also it gives advantage to the people to access from one city to another city within the short journey time.

1.1 Aim

Proposing the successful design model for the high-speed rail station and supporting commercial facilities.

1.2 Objective

Study of existing land uses around the station influence area.Study the type of passengers, flow and their facilities required for the station.

1.3 Scope

Formulating design principles for the High-speed rail station. Proposing mixed-use development.

1.4 Limitations

The station influence area considered as 800 M radius from the proposed site.

The midrise development is proposed based on the neighborhood land use analysis.

2.0 Literature review

2.1.1 Development model

- Model -1 : Area development authority led business model.
- Model -2: Monetization of railway surplus land assets located at prime location.
- Model -3 : Transferrable development rights
- Each of the above models if implemented can contributed to the project capex financing as well as enhancing non-fare box revenues.

Non railway business fig 2.1

Combination of four disciplinary approaches development model

- Connector : A built environment connecting the various transportation modes.
- Transportation node: characterized by its hierarchical position with the networks
- Meeting place : A modern market place where people are confronted with urban life in all its multiplicity.
- Urban center: Provides a scarce resource of land that accommodates dense and mixed-use developments.

Principles for successful development around transit

- A defined vision - to make development superior

Making retail development - market driven rather than transit driven the development of a HSR means the development of the surrounding Land, resulting in increase of footfall of the station and the land around is used effectively. Public-Private Partnerships- Making development powerful and exclusive.

Four main zones

Arrival zone

The arrival zone is the outer area where a station and its surroundings meet: a station's set-down/pick-up zone.

Image Reference : Uppasala Central HSR Station, Sweden

Service zone

There are services that, to varying degrees, are directly related to a journey. Primary functions are ticket sales, ticket machines, information desks, traffic information, toilets and waiting areas.

Image Reference : Uppasala Central HSR Station, Sweden

Platform

Platforms are located closest to the tracks. One can board, and alight from local trains, regional trains and long-distance trains, and in some cases, directly change to bus.

Image Reference : Uppasala Central HSR Station, Sweden

Communication zone

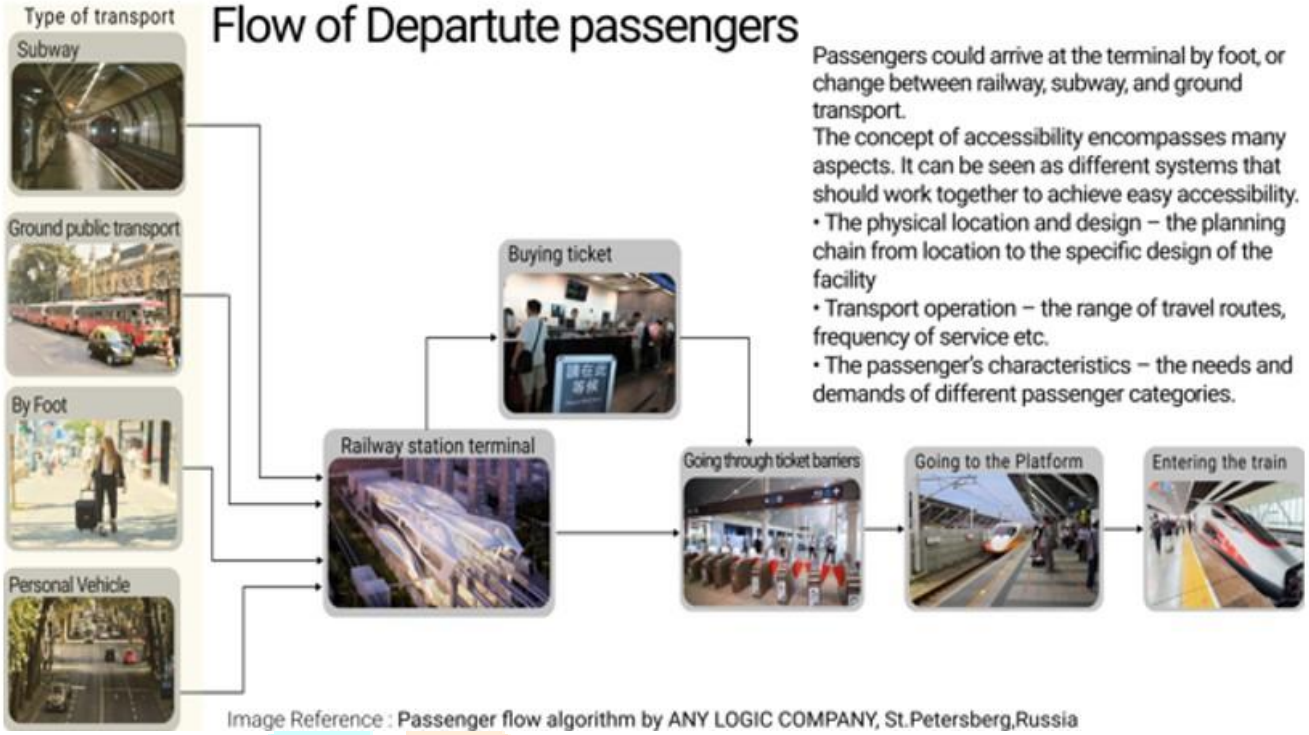
A communication zone connects set-down/ pick-up zones with platforms, sometimes via the service area.

Image Reference : Gothenburg Central HSR Station, Sweden

2.1.2 Flow of passengers

Primary Flows:
- Passenger flows from various set-down/ pick-up zones to platforms/departing trains.
- Passenger flows from arriving trains to various connections for travelling further or for the termination of the journey.

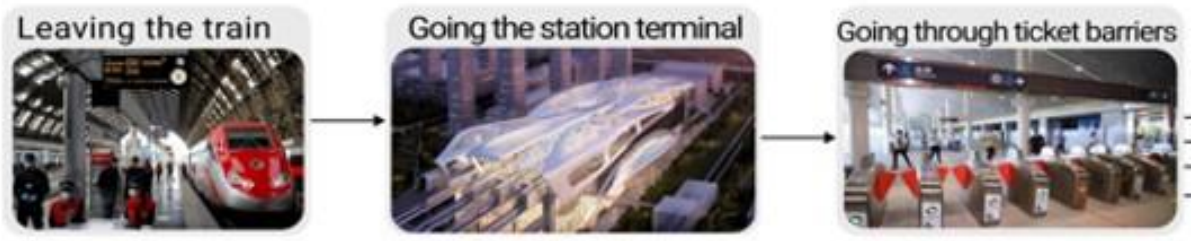
Secondary flows:
- Individuals visiting a station for other purposes, e.g., to meet or drop-off a passenger
- Other visitors, e.g., customers at restaurants, shops, kiosks etc.
- Supply flows: goods to restaurants, shops, kiosks.



Departure passenger flow fig 2.2

2.1.3 Flow of arrival passengers

- For a ride to work , an opportunity should be provided to spend any waiting time in a convenient manner , regardless of the type of station concerned.
- There should be access to pre-ordered taxis at main stations.
- At the biggest stations, so called taxi will be placed closer to the entrance than the long-term parking, but not at the expense of bicycle parking and public transport.
- Fast and secure transfers between different types of public transport should be given high priority within the station.



Arrival passenger flow fig 2.3

2.2 Literature review Inference

● Transit oriented development component to be implemented in the planning.

● Principles of successful development around transit to be followed in the master planning.

● Proper development model mix to be identified and implemented for the success of the project.

● all the range of passenger visiting in the station needs to be considered in the planning.

3 Case study

3.1 Net case study

3.1.1 Rotterdam Central

Brief:

Rotterdam was founded in 1270 and has been one of Europe's major commercial cities .Located at the Rhein-Meuse-Scheldt river delta, the city has the busiest port in Europe. More strategic architectural and urban planning concepts emerged in the1980s, with decision-makers now actively trying to turn Rotterdam into one of Europe's most important cities for modern architecture. Along with this transformation. Rotterdam benefits immensely from its proximity to Amsterdam and Brussels, serving as an intermediary station along a new international high-speed route that also puts Paris, London and Cologne within easy reach.

The opening of the Netherlands' new High-Speed Line South put Rotterdam a mere twenty-minute ride from Amsterdam Schipol, the country's main international airport, while Brussels and Paris are now only one hour ten minutes and two hours forty minutes away, respectively.

Region	
Location	Rotterdam, Netherlands
Population	610,000 (city) ~1,200,000 (metropolitan area)
Population Density	7,690 people per square mile
Station	
Location	Gateway to city center on one side, historic district on the other
Type of Project	New construction Old station closed in 2007, new station opened in 2014
Station Size	Gross floor area: 46,000 square meters
Types of Land Uses	Commercial, residential, hotel, office
Parking	750 new spaces to connect with existing car park
Elevation	Station at grade. Rail tracks above.
Transportation Modes	High-speed rail, regional trains, metro, taxi, bus, trams, car, motorcycle, and bicycle parking

Sources: misc. incl. Wikipedia, Terrin (2009), Griffiths (2014) and personal observation.

3.1.2 Station and station-area

Neighbourhood Context

Rotterdam Centraal is a station located at the intersection of two very different neighbourhoods, and thus correspondingly features two very different facades. Thus, the station site plan needs to appropriately address two very different contexts. Accordingly, the northern entrance of the station was designed to handle a smaller number of passengers.

Evaluation and lessons learned

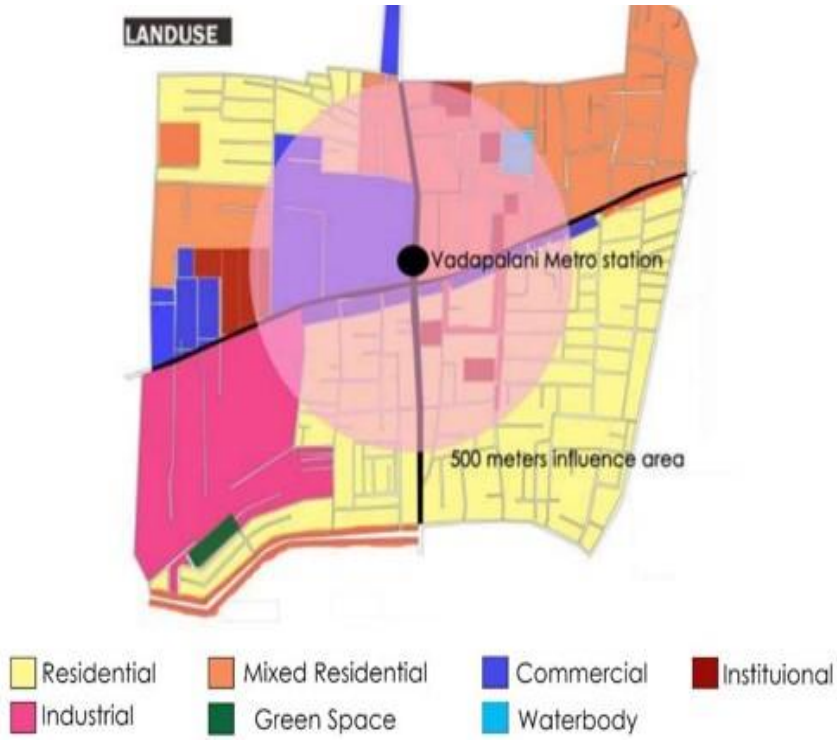
Rotterdam Centraal has the appropriate structure and dimensions for the urban landscape; it is in balance with the heights that characterize the metropolis and simultaneously reflects the human scale.

A good design solution to a situation where a station straddles two distinctly different neighbourhoods.

3.2 VADAPALANI METRO RAIL STATION

Vadapalani metro station is located on the western part of the city, a residential neighborhood which also includes software industries, shopping malls, theatres , university, school, hospital etc, this is a typical neighborhood scenario for any neighborhood in the Chennai city.

The station is an elevated station at the junction of jawarharlal Nehru road and arcot road. At 16 metres above the street level.



Source: D. Karthigeyan and Dr. Sheeba Chander, Impact of 5 D"s of

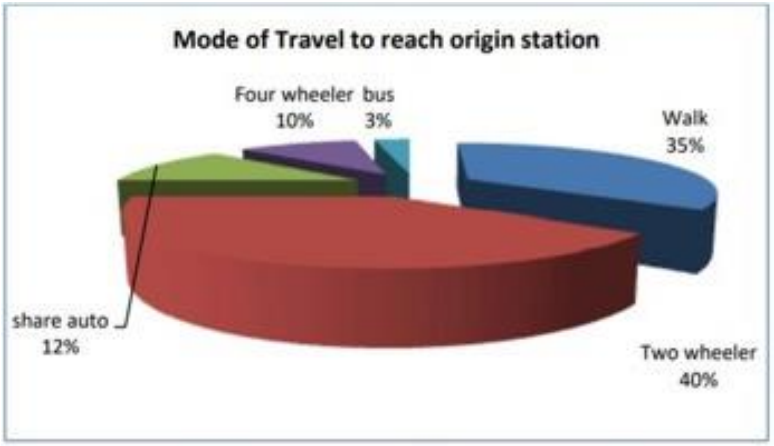
Development on the Patronage of a Transit Network – A Case Study of Vadapalani

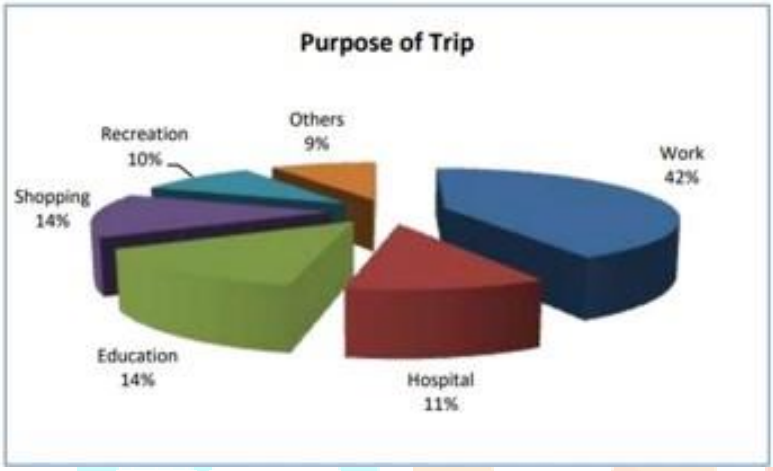
Analysis and inference of the data collected through the primary survey and its observations are, Maximum number of trips is found to be work related trips (42%) followed by education , shopping and health care . the reason being destination accessibility like major offices, hospitals cum medical college and shopping malls are located very close to the station.

Sl. No	Land use	Percentage
1	Residential	38 %
2	Mixed residential	28.6 %
3	Commercial	8.1 %
4	Industrial	16.75 %
5	Institutional	6.25 %
6	Open space & water body	2.3 %
Total		100

Chennai Municipal Corporation	Total population	Total Area of ward (in hectares)	People / hectare	Area (500 m from station) (in hectares)	People living within 500 Meters
Ward No.117	36,192	75.13	482	38.06	18334
Ward No.121	25,912	67.37	385	29.09	11189
Ward No.129	59,322	236.26	251	9.94	2496
Total				77.09	32019

Source: Census of India, 2011.





Around 80% of the passenger fall between the age group of 20 to 40, which is linked with the quality of acess roads for the cyclist , elderly and the pesdestrians to reach the station.other age groups especially children are not using this metro rail due to vulnerability of the access to accidents.

3.3 Case study Inferences

● A viable business model along the rail corridor is concrete indication that synergy between transportation, real estate and retail can be achieved within the geographical scope of a transit corridor.

● Land use density is higher around the station to encourage the more number of ridership.

● The land use density should be considered relatively compare to its neighborhood.

● Network neighbourhood connectivity used as an important tool in the station development.

● the non-residential area attract more transit trips compare to the residential area.

● there is a decrease in residential land use and increase in commercial land use in all the station influence zones due to the presence of metro station.

● The multi modal transportation and its connectivity from the metro station, encourage the passenger to use the metro facilities.

● Last mile connectivity within the walkable distance of 10 minutes are preferable.

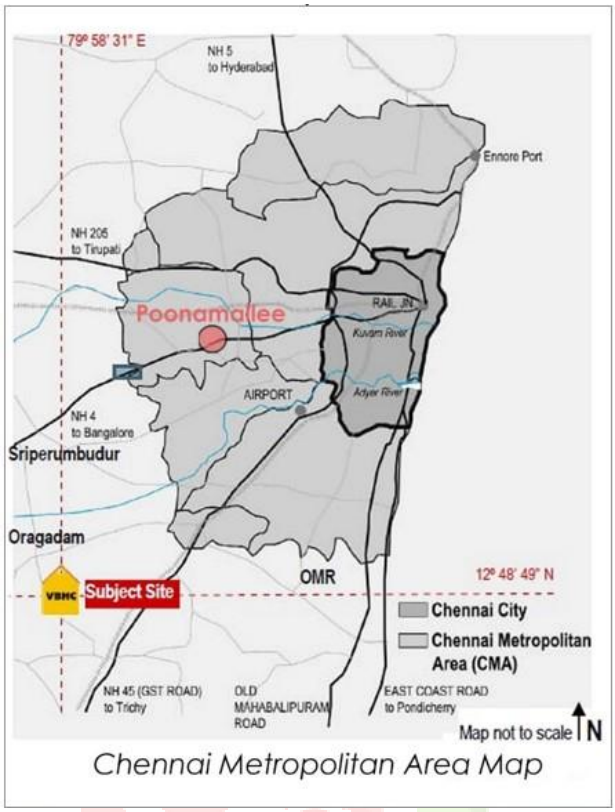
● Vehicular and Pedestrian circulation to be segregated. Pedestrian friendly design is preferable.

4.0 - SITE ANALYSIS

Poonamallee is governed by Municipality of Poonamallee, coming under the Tiruvallur district. Poonamallee Municipality is situated in the West Chennai of Tamil Nadu in Tiruvallur District.

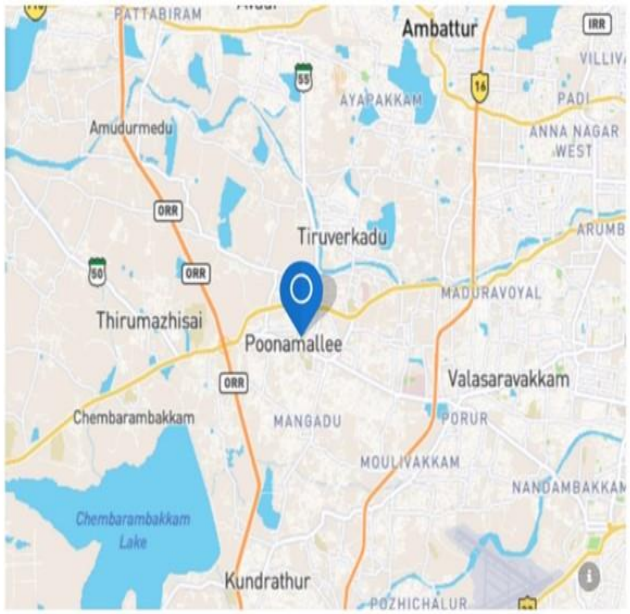
It acts as the gateway to the city from its western side. It is a town with rich cultural heritage and a fast-growing area in the city. This town is surrounded with infrastructural facilities and it is near to Chennai Metropolitan Bus Terminal (CMBT).

Poonamallee is located around 22.2 kilometer away from its district head quarter Tiruvallur. The other nearest district head quarters is Chennai situated at 20.7 km distance from Poonamallee.



Chennai Metropolitan Area Map

Chennai metropolitan area map : fig 4.1



Neighbouring Places to Poonamallee (within 10 -12 km)

As per Census 2011 Poonamallee taluk is comprised of

Municipalities : 3	Town panchayats : 2
Census town : 6	Villages : 24

Neighboring places of poonamallee Map: fig 4.2

Source: From Wikipedia, the free encyclopedia

4.1 poonamallee demographics

Poonamalee Demographics

	2001	2011	2021 Exponential	Growth (%)
Population	431758	659922	1008660	52.85 %
Male population	220625	333307	503540	51.07 %
Female population	211133	326615	505261	54.69 %
Population density	2421	3701	5658	52.80 %
Sex Ratio	957	980	1004	2.40 %
Male Literates	176898	277354	434856	56.70 %
Female Literates	144522	245900	418392	70.14 %
Workers (overall)	33.6 %	37.90 %	42.2 %	4.30 %
Non Workers (overall)	66.4 %	62.10 %	57.8 %	-4.30 %

Source: Census of India 2001, Census report 2011, District human development report 2017

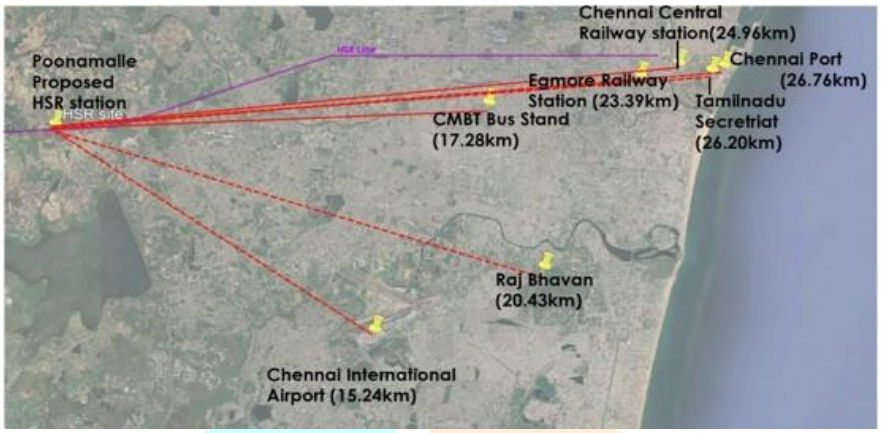
Poonamallee climate: fig 4.3

4.2. Site selection

Two site location has been identified based on the line of alignment of NHRSCL in poonamallee. Site 1 with the plot area of 64.10 acres access from the poonamallee tiruvallur state highway. The site 2 with the area of 167 acres parcel access from outer ring road.

The site 1 is selected for the proposed high-speed rail station. It has very good accessibility and public amenities available near the site surrounding.

4.2.1 The proposed Site

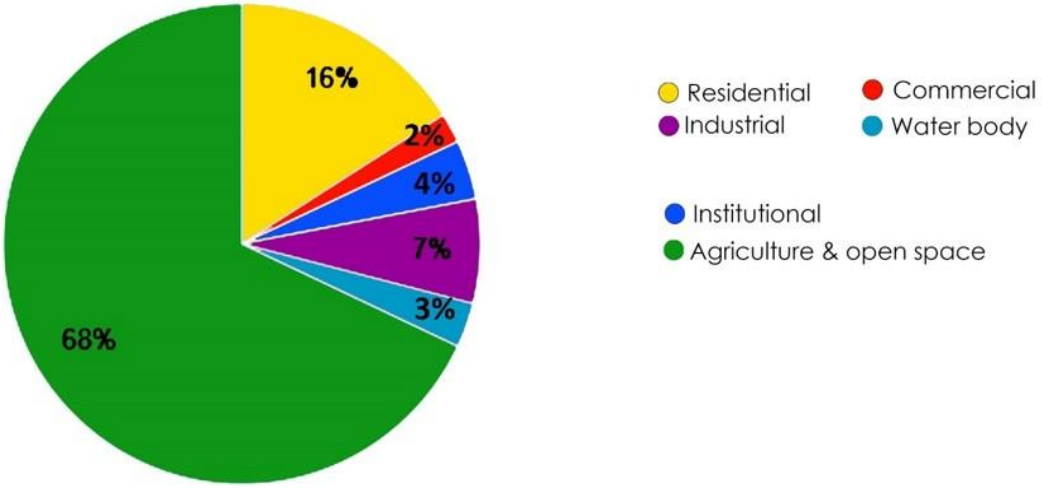


Major Road Networks around HSR Station

Legends

1 - Nazrathpeth Junction
2 - Chennai Outer Ring Road (6 Way)
3 - Chennai - Bengaluru Highway (4 Way)
4 - Thiruvallur - Poonamallee Road
5 - Poonamallee - Pattabiram Road

Area around 800m radius from HSR station



Land use around the proposed site: 4.3

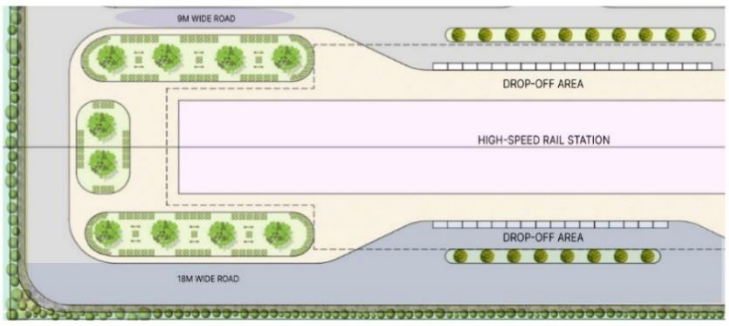
5 .0. Requirement

The following project requirement formulated based on the land use study around the station influence area of 800m radius.

- High-speed rail station
- Shopping Centre
- Multipurpose hall
- Commercial office
- 3 star hotel

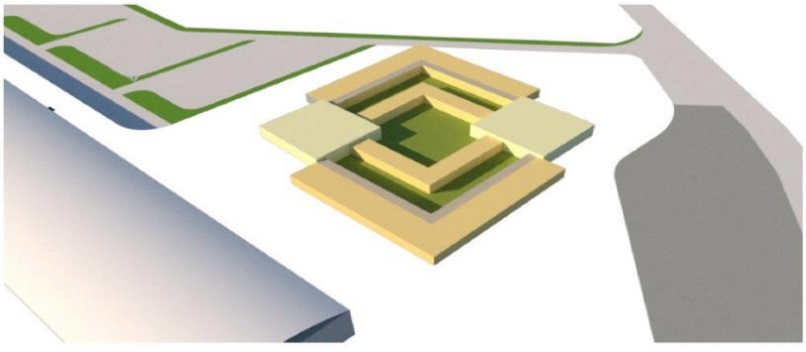
6.0 Concept

DESIGN PRINCIPLES



COMPLETE STREETS

The internal road network is segregated and given with sufficicent buffer zones making it traffic free, reduces the surrounding noise and ensuring safety to the pedestrians as well as other users of the station.

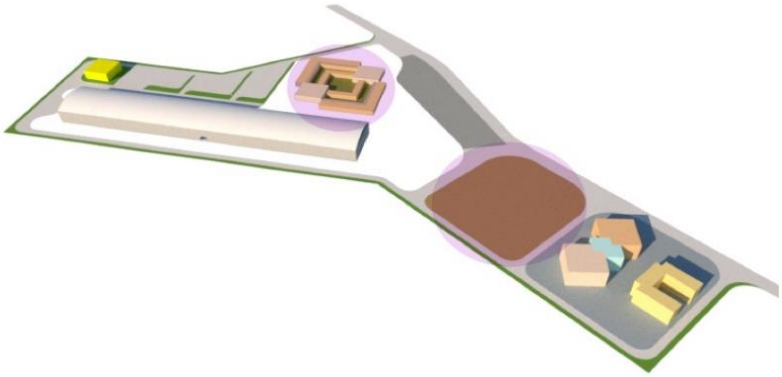


CREATING A SENSE OF SPACE

The plazas created as buffer zones throughout the site are thoughtfully placed keeping in mind the usage by massess .
The plazas are easily accessible for all age groups making it a user friendly open landscape as well as recreation space.

MULTI-MODAL INTEGRATION

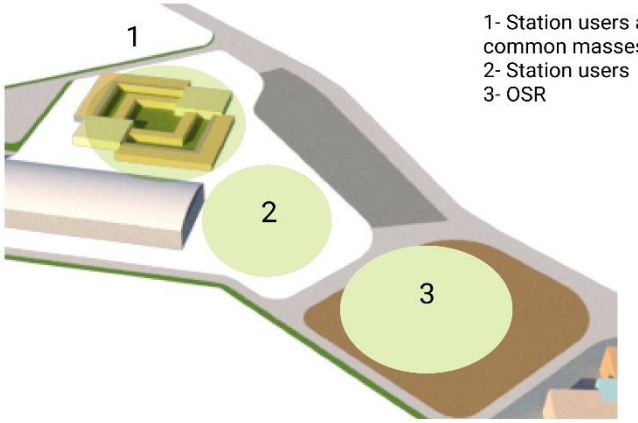
1/4 mile walking distance /
5 minutes walking distance for accessing the high-speed rail station facilities.



INCLUSIVE HABITAT

Plazas are barrier free and serve aas gathering spaces for people accessing the high speed rail and common masses.

The plazas are informally segregated for different kind of users.



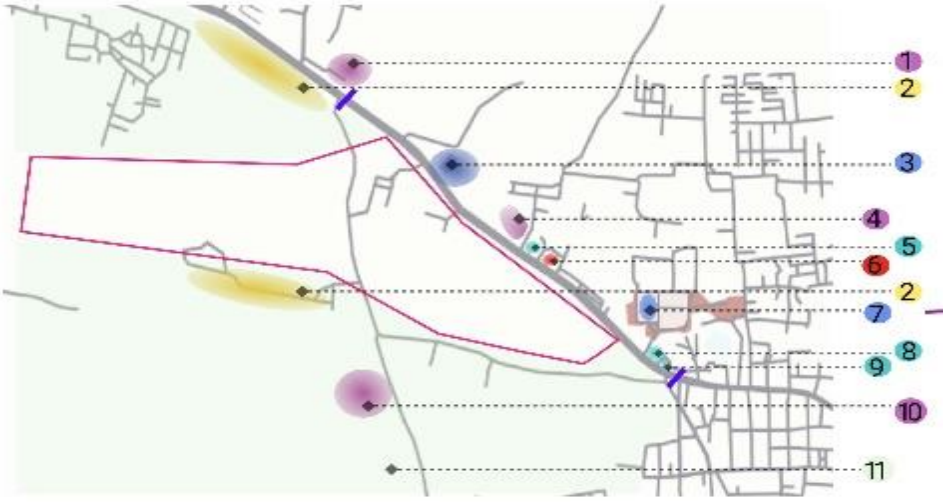
1- Station users and common masses
2- Station users
3- OSR

HIERARCHY OF PLAZAS

The principal concept of the master plan is based on the hierarchy of open spaces which make up the plazas- the concept which is derived from creating a sense of space for the users.

The plazas are zoned in such a way that no part of the site is isolated and people can move around.

LAND USE AROUND THE SITE(800m radius)

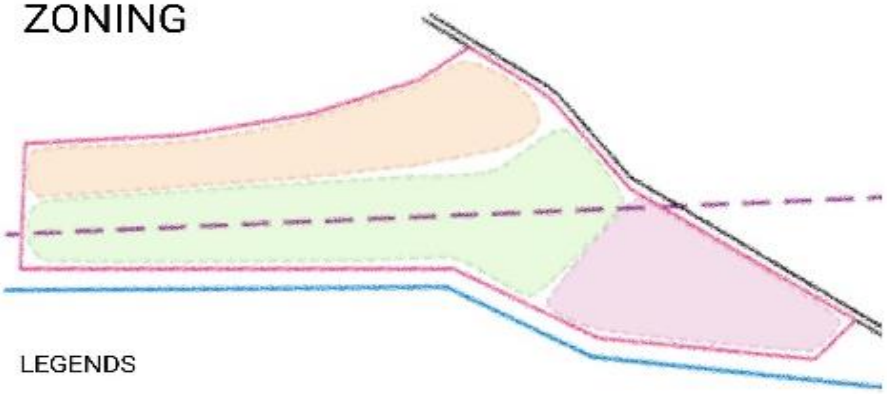


LEGENDS

1. NMZ Enterprises
2. Residential
3. Sundaram Government Higher Secondary School
4. Sam Southern Manufacturing Company
5. Ilangali Amman Temple , Thirumazhisai
6. Bharat Petroleum petrol Bunk
7. Chennai Public School
8. Government primary Health Center
9. Thirumazhisai Bus Terminus
10. Flowcon Chemical Manufacturer
11. Agricultural land

Site boundary

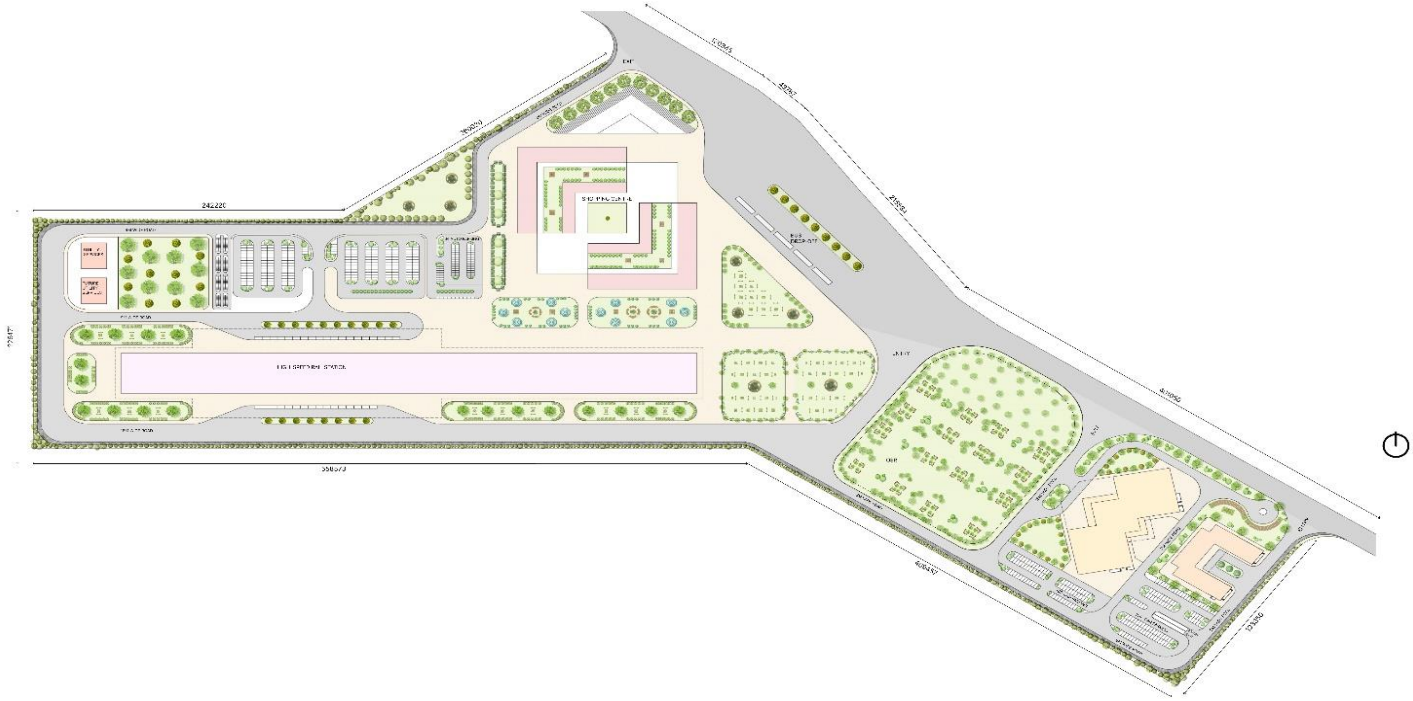
ZONING



LEGENDS

- High Speed Rail - Passenger supporting amenities
- High Speed Rail - Station Plaza
- Multipurpose hall
  Hotel
  Business center
- High Tension Line
- Site Boundary
- High Speed Rail - Line of Alignment
- Abutting Road- Thiruvalluvar High Road

7.0 Master plan



7.1 Conceptual aerial view

8 .Conclusion

As a form of infrastructure, HSR is inevitably tied to an intricate web that overlaps urban–regional functions and the geographic expanses of human life. These overlaps induce complexity but, if developed as an integrated system, can achieve significant outcomes for the overall betterment of life.

The following factors are important for the developing the high-speed rail station as neighbourhood friendly.

●The influence zone of a transit station is important area to be developed in correlation with the network neighborhood relatively.

● The land use and density proportion mix shall be relative to the network neighborhood.

● The required percentage of area shall be included in the station area development for station plazas, forecourts, open spaces & parks to enhance the passenger comfort experience.

● Last mile connectivity within the walkable distance of 10 minutes is necessary for the success of the high speed rail station project.

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