Strategies and Land Use Restructuring for Transit Oriented Development in Ahmedabad, using Geographical Information System (GIS)

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INTRODUCTION

• Government of Gujarat in association with Ahmedabad Urban Development Authority (AUDA) has made its Development Plan – 2021 considering Smart City, TOD and CBD.

• TOD = Transit Oriented Development

• A transit-oriented development (TOD) is a mixed-user residential and commercial area designed to maximum access to public transport and often incorporates features to encourage transit ridership.

• TOD is an overall approach to development. Simply locating near transit does not make an area oriented towards transit.

• Transit Oriented Development is a promising concept which binds Land Use, Sustainability and Transportation together.

• TODs are generally done within a radius of one-quarter to one-half mile (400 to 800 m) from a transit stop, as this is considered to be an appropriate scale for pedestrians to approach transit station.

• TOD encourages:-
  • Seamless Mobility.
  • Smart Growth of the City.
  • Attractive, Safe and Walkable neighborhood.
  • Lesser Traffic and Smoother Mobility.
  • Land Use Transportation Integration.
  • Reduction in Travel Time.
  • Improved Urban Environment.
CITY PROFILE - AHMEDABAD

- Largest City and former capital of Gujarat State.
- 5th Largest City and 7th Largest Metropolitan Area of India.
- Regarded as one of the fastest growing cities in India.
- Population: 6.3 Millions.
- 3 Main Public Transportation City
  - Ahmedabad Municipal Transportation System (AMTS)
  - Bus Rapid Transportation System (BRTS)
  - MetroLink Express Gandhinagar and Ahmedabad (MEGA)
STUDY AREA

- Study Area is divided into total of 6 wards.
- Study Area is a linear stretch of 4.5 Km.
- 500m of buffer area is taken into consideration.
- Study area encapsulates 6.0 Sq. Km. of Land.
- Total Population of Study Area is 85,000 (As per Census – 2011).
- Average Density turns out to be approx. 14,400 / Sq. Km.
- A rich mixture of mixed land use is present.
- Since the area is more business oriented, large number of commuters commute daily.
- Two major public transports are being used:
  - AMTS
  - BRTS
- Available FSI in the study area is 4.0 out of which on an average Only 1.8 FSI is used.
OBJECTIVE

• To prepare conceptual plan(s) / strategy(s) for our study area which can provide a helpful guide to the person who will be preparing the final Local Area Plan (LAP).

• To assess the current scenario of our study area and produce analytical maps on ESRIs ArcGIS.

• Current Scenario should be analyzed for:
  • Existing Demography
  • Existing Land Use
  • Existing Physical Infrastructure
  • Existing Traffic Condition
  • Existing Public Transportation.

• On complete understanding of current scenario, restructured scenarios shall be prepared and analytical maps should be produced used ESRIs ArcGIS.

• Restructured Scenario(s) shall be prepared for:
  • Restructed Land Use
  • Restructured Physical Infrastructure
  • Restructed Traffic Scenario
  • Alternatives to find a way to link AMTS and BRTS.
CURRENT SCENARIO: DEMOGRAPHY

Wardwise Population (2011)

Legend
Population

- 159
- 1,676
- 9,012
- 9,522
- 23,505
- 40,355
CURRENT SCENARIO: DEMOGRAPHY

Wardwise Density (2011)

Legend
Density (Pop / Sq. Km.)
- 4,092
- 5,157
- 6,113
- 7,916
- 20,955
- 22,746
CURRENT SCENARIO:
LANDUSE
CURRENT SCENARIO: LANDUSE
CURRENT SCENARIO:
LANDUSE
CURRENT SCENARIO:
PHYSICAL INFRASTRUCTURE

Road Network

Legend
- Traffic Junction

Road Network
- Major Roads
- Collector Roads
- Street Lanes

Land Use
- Commercial
- Institutional
- Mix
- Open Plot
- Recreational
- Residential
- Slums

Scale: 1:15,000
CURRENT SCENARIO: PHYSICAL INFRASTRUCTURE

Major Road with BRTS Stop
CURRENT SCENARIO: PHYSICAL INFRASTRUCTURE

Major Road with BRTS
CURRENT SCENARIO:
PHYSICAL INFRASTRUCTURE
CURRENT SCENARIO:
PHYSICAL INFRASTRUCTURE

Street Road

[Diagram showing a street with buildings and cars, indicating no turn lanes.]
CURRENT SCENARIO: PHYSICAL INFRASTRUCTURE

Collector Road
CURRENT SCENARIO:
TRAFFIC CONDITION

Traffic Volume (Weekday)

Legend
- Traffic Junction
- Road Network

Count
- PCU
- Morning
- Afternoon
- Evening

Land Use
- Commercial
- Institutional
- Mix
- Open Plot
- Recreational
- Residential
- Slums
CURRENT SCENARIO:
TRAFFIC CONDITION
CURRENT SCENARIO:
TRAFFIC CONDITION

Traffic Condition (Weekday - Evening)
CURRENT SCENARIO:
TRAFFIC CONDITION

Traffic Condition (Weekend - Morning)
CURRENT SCENARIO: TRAFFIC CONDITION

Traffic Condition (Weekend - Afternoon)
CURRENT SCENARIO: TRAFFIC CONDITION

Traffic Condition (Weekend - Evening)

Legend
- Traffic Junction
- Road Network

Condition
- Congested

Land Use
- Commercial
- Institutional
- Mix
- Open Plot
- Recreational
- Residential
- Slums

1:15,000

0 0.375 0.75 1.5 Kilometers
CURRENT SCENARIO: TRAFFIC CONDITION

Street Parking

Speed of Vehicle (km/h)
CURRENT SCENARIO: PUBLIC TRANSPORTATION

Modes of Transportation

MODES OF TRANSPORT
- Private Transport 83%
- Intermediate Transport 15%
- Public Transport 2%

PRIVATE TRANSPORT
- Four wheeler 64%
- Two wheeler 35%
- Bicycle 1%
CURRENT SCENARIO:
PUBLIC TRANSPORTATION

BRTS Routes and Junctions

Legend
- BRTS Junction
- Road Network

Route Phase
- Phase I
- Phase 2

Land Use
- Commercial
- Institutional
- Mix
- Open Plot
- Recreational
- Residential
- Slums

1:15,000

0 0.375 0.75 1.5 Kilometers
CURRENT SCENARIO: PUBLIC TRANSPORTATION

BRTS Bus Frequency (Weekday)

Legend
- BRTS Junction

Route Phase
- Phase I
- Phase II

Load
- Count
- Morning
- Afternoon
- Evening

Land Use
- Commercial
- Institutional
- Mix
- Open Plot
- Recreational
- Residential
- Slums
CURRENT SCENARIO:
PUBLIC TRANSPORTATION
**CURRENT SCENARIO: SWOT ANALYSIS**

## SWOT Analysis

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<tbody>
<tr>
<td>The study area encapsulates varied types of land use.</td>
<td>Huge parking problems for commercial shops.</td>
<td>Large portion of vacant land are publicly owned and therefore readily available for desired development, particularly housing schemes and parking plots.</td>
<td>Due to poor maintenance of open plots, they can tend to convert into either waste disposal site or slums very rapidly.</td>
</tr>
<tr>
<td>A Good mixture of residential buildings and commercial activities.</td>
<td>None of the roads parallel to BRTS corridors are as per IRC standard road widths.</td>
<td>Providing better social facilities.</td>
<td>Every chances of roads, which are not as per IRC road width standards, to get over flooded with increase in population.</td>
</tr>
<tr>
<td>Large available workforce and strong presence of local market.</td>
<td>All roads parallel to BRTS corridors goes congested in peak hours.</td>
<td>Establishment of good formal market.</td>
<td>Street parking is increasing day by day.</td>
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<td>Availability of large unused open plots.</td>
<td>AMTS and BRTS buses runs parallel to each other.</td>
<td>Good networking between AMTS and BRTS with proper parking space can bring public transport into lime light.</td>
<td>Chances of increase in land values with increase in FSI.</td>
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<td>Existing multi-public transport system like AMTS and BRTS.</td>
<td>People still tend to use private vehicles though public transport is available.</td>
<td>Creating a green environment around transit station with proposed increase in FSI.</td>
<td>Once the area is upgraded, a possibility that, the process of gentrification may take place.</td>
</tr>
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Restructured Land Use Scenario:

Proposed FSI:

- 2.7
- 4
RESTRUCTURED SCENARIO: LANDUSE
Restructured Scenario: Landuse

Restructured Land Use in 200m Buffer

- Mix: 60%
- Residential: 21%
- Commercial: 6%
- Parking Plot: 2%
- Recreational: 8%
- Institutional: 3%

Existing vs Restructured Land Use in 200m Buffer (%)

- Mix: Existing = 60%, Restructured = 43%
- Commercial: Existing = 21%, Restructured = 15%
- Residential: Existing = 30%, Restructured = 21%
- Institutional: Existing = 1%, Restructured = 6%
- Recreational: Existing = 1%, Restructured = 8%
- Slum: Existing = 1%, Restructured = 8%

Graphs showing the comparison of existing and restructured land use distribution in a 200m buffer area.
RESTRUCTURED SCENARIO: LANDUSE

Restructured Land Use in 300m Buffer

- Residential: 45%
- Commercial: 27%
- EWS: 10%
- Institutional: 10%
- Recreational: 2%
- Mix: 1%

Existing vs Restructured Land Use in 300m Buffer (%)
Changes Made and Strategies Used to Restructure Physical and Traffic Scenario

- All types of roads were redesigned as per IRC standards.
- All roads were redesigned taking into consideration “Transit Oriented Development”.
- AMTS buses are restricted to run on all the major roads specially on the major roads having BRTS.
- Heavy vehicles like trucks are restricted to run on major roads between 8:00 AM to 10:00 PM everyday.
- Street parking is completely banned.
RESTRICTED SCENARIO: PHYSICAL INFRASTRUCTURE AND TRAFFIC CONDITION

Existent vs Revised Traffic Condition

(Weekend)

Existent vs Revised Traffic Condition

(Weekday)
RESTRUCTURED SCENARIO:
PUBLIC TRANSPORTATION

Accessibility / 5 Mins Walkable Distance (200m Buffer)
Restructured Land Use (200m Buffer) around BRTS Stops

**Restructured Scenario:**

**Public Transportation**
Restructured Land Use (200m Buffer) around BRTS Stops

Restructured Scenario: Public Transportation

Existing vs Restructured Land Use (200m Buffer) in Parshwanath Jain Mandir (%)

Existing vs Restructured Land Use (200m Buffer) in Parasnagar (%)
Interconnectivity between BRTS and AMTS

Sample Interconnectivity
An example of BRTS and AMTS networking is shown here. Suppose a person wants to travels from Kamnath Mandir (Darpan) to Sattadhar Society using public transport. The best possible way he/she can adopt is to take AMTS (Point 1), reach near by by BRTS station (Point 2), take up BRTS bus (Point 3) and reach his/her destination (Point 4). Since AMTS are not allowed on any major roads, no direct connectivity will be able form Kamnath Mandir (Darpan) to Sattadhar society, hence if he/she wants to travel by public transport, above route is the best route available.
CONCLUSION

• Besides producing beautiful maps ESRIs ArcGIS analytical tools like Network Analysis, Buffer, Site Suitability had a big impact on proposing restructured scenarios.

• Implementation of results obtained by this pilot project on whole Ahmedabad city has a tremendous potential to restructure the way TOD, Land Use and Existing Transportation works.

• On using network analysis and putting barriers on those routes where AMTS and BRTS runs parallel and reducing time for heavy vehicles like Trucks entering in the city from 8:00 AM to 10:00 PM, considerable reduction in vehicle traffic was obtained.

• Integrating ESRIs ArcGIS with Urban Planning, Transport Planning, Site Assessment helps in better decision making and proposing refined / restructured Conceptual Plan (s) / Strategy(s)
THANK YOU