Assessing the Impact of Regional Rapid Transit System on Urban Mobility in Meerut City: A Planning-Based Study of Accessibility, Congestion and Station Influence

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Abstract

Urban mobility in medium-sized Indian cities is increasingly affected by rapid urban growth, increasing private vehicle ownership, mixed land-use development, inadequate public transport integration and rising congestion on major urban corridors. Meerut, a major urban centre in western Uttar Pradesh and an important city within the National Capital Region influence area, has been experiencing increasing mobility pressure along key corridors such as Delhi Road, Garh Road, Hapur Road and other major arterial routes. In this context, the Delhi–Ghaziabad–Meerut Regional Rapid Transit System has emerged as a major regional transport intervention intended to improve connectivity, reduce travel time and promote a shift towards public transport. This research paper examines the impact of RRTS on urban mobility in Meerut city with a specific focus on city-wide accessibility, travel-time improvement, modal shift potential, station influence, last-mile connectivity and integration with the existing urban transport structure.

The study adopts a mixed-method and planning-oriented approach. Secondary data from project documents, NCRTC references, appraisal documents, demographic sources and policy frameworks is combined with field-based interpretation of mobility conditions, station influence and access-related issues. The paper evaluates the role of RRTS at two spatial levels: the macro level, covering the overall mobility structure of Meerut city, and the micro level, focusing on selected RRTS station influence areas including Meerut South, Shatabdi Nagar, Begumpul and Modipuram. The Delhi–Ghaziabad–Meerut RRTS corridor is an 82 km corridor with 16 Namo Bharat stations and 9 additional Meerut MRTS stations, making it a significant regional and urban mobility intervention for Meerut.

The study finds that RRTS has the potential to significantly improve regional connectivity, reduce long-distance travel time, support modal shift and strengthen the public transport backbone of Meerut. However, the city-level benefits depend heavily on station-area integration, pedestrian access, feeder services, parking management, IPT regulation and transit-oriented planning. The research concludes that RRTS should not be treated only as a regional rail project, but as a catalyst for restructuring urban mobility in Meerut through integrated city planning and station-area development.

Keywords: RRTS, Urban Mobility, Meerut City, Accessibility, Traffic Congestion, Last-Mile Connectivity, Transit-Oriented Development, Station Influence, Regional Planning

Introduction

Urban transportation systems play a critical role in shaping the efficiency, productivity, accessibility and livability of cities. In Indian cities, especially medium-sized and rapidly growing urban centres, mobility challenges are becoming increasingly complex due to urban expansion, rising vehicle ownership, mixed traffic conditions, informal public transport dependence and weak integration between land use and transport. While metropolitan cities have received significant investment in metro rail, bus rapid transit and integrated public transport systems, medium-sized cities such as Meerut continue to experience congestion and mobility-related challenges without adequate integrated planning responses.

Meerut is one of the most important urban centres in western Uttar Pradesh. It functions as a residential, commercial, educational, industrial and service hub, generating significant daily travel demand both within the city and between Meerut and the National Capital Region. Its proximity to Delhi and Ghaziabad has increased its regional importance, but at the same time has also contributed to pressure on road infrastructure and commuter corridors. The city's mobility structure is strongly dependent on road-based travel, informal public transport, two-wheelers, cars and intermediate public transport modes such as auto-rickshaws and e-rickshaws. Congestion is particularly visible along major corridors such as Delhi Road, Garh Road, Hapur Road, Modipuram side approaches and central commercial areas.

Need for the Study

Medium-sized cities in India are increasingly facing mobility challenges similar to large metropolitan areas, but without the same level of institutional and transport planning capacity. Meerut is a clear example of this transition. Its regional importance, urban expansion and economic activities have increased travel demand across major corridors. At the same time, a large share of mobility continues to depend on road-based and informal modes, leading to congestion, travel-time uncertainty, parking problems, pedestrian safety issues and inefficient public transport integration.

The RRTS provides an opportunity to reduce regional travel time and strengthen public transport orientation, but its role in reducing urban congestion and improving city-level mobility needs careful assessment. Regional transit systems are often planned at the corridor scale, but their local impacts are experienced at the station and city level. If station areas remain poorly connected, if feeder services are weak, and if pedestrian access remains unsafe, the full potential of RRTS may not be realized.

Aim and Objectives

The aim of this study is to assess the impact of the Regional Rapid Transit System on urban mobility within Meerut city, with specific reference to accessibility, travel-time change, mode choice, station influence and planning integration.

The objectives of the study are as follows:

1. To study the existing urban mobility structure of Meerut city.
2. To analyze the influence of RRTS on city-wide accessibility and travel behavior.
3. To assess station influence areas around selected RRTS stations within Meerut city.
4. To identify mobility issues related to last-mile connectivity, integration and station access.
5. To propose planning strategies for improving urban mobility through RRTS integration.

Research Questions

The study is guided by the following research questions:

1. What are the existing mobility challenges and congestion-related issues in Meerut city?
2. How does RRTS influence city-wide accessibility and travel-time efficiency in Meerut?
3. What is the role of selected RRTS stations in shaping local mobility and station-area movement?
4. How do last-mile connectivity, pedestrian access and feeder integration affect the urban mobility impact of RRTS?
5. What planning strategies can improve RRTS integration with Meerut's urban transport and land-use structure?

Study Area

The study area is Meerut city, located in western Uttar Pradesh. Meerut is an important city within the broader National Capital Region influence area and has strong regional linkages with Delhi, Ghaziabad and other surrounding settlements. The city has mixed land-use characteristics, including residential areas, central commercial zones, institutional clusters, industrial activities, transport terminals and expanding urban fringes. Meerut district has a reported population of 3,443,689, a density of 1,346 persons per sq km, a literacy rate of 72.84 percent and a sex ratio of 886 females per 1000 males, according to official district demographic information.

Review of Literature

Urban mobility literature emphasizes that transit infrastructure affects city movement not only by providing transport capacity but also by reshaping accessibility, travel behavior, land use and development patterns. Public transport systems can reduce travel time, improve access to employment and services, and support sustainable mobility when they are

integrated with feeder systems and pedestrian networks. However, poor station access and weak last-mile connectivity can reduce the effectiveness of even high-quality transit systems.

Studies on metro systems and rapid transit in Indian cities show that accessibility, travel time, mode choice and interchange quality are among the most important determinants of transit ridership. A transit system's performance depends not only on in-vehicle speed but also on the total travel experience, including access time, waiting time, transfer quality, walking conditions and destination-side connectivity. This is especially relevant in cities where intermediate public transport and informal feeder services form a large part of daily movement.

The concept of station influence is also important in transit planning. Transit-oriented development frameworks generally emphasize compact, mixed-use and pedestrian-friendly development around transit nodes. In the case of the Delhi–Ghaziabad–Meerut RRTS, the TOD framework identifies station influence zones and highlights the importance of land-use transport integration. The NCRTC TOD knowledge framework refers to station influence and planning provisions linked to the RRTS corridor, which supports the use of station influence zones in this research.

The review indicates that while significant research exists on metro systems, accessibility and mode shift, localized studies on the effect of RRTS on medium-sized cities remain limited. The Delhi–Meerut RRTS is India's first operational regional rapid transit system, and Meerut provides an important case for understanding how such infrastructure interacts with the urban mobility structure of a growing city.

Existing Urban Mobility Conditions in Meerut

Meerut's existing mobility pattern is strongly road-based. Daily movement is supported by a combination of private vehicles, two-wheelers, shared autos, e-rickshaws, buses and informal public transport. Major corridors such as Delhi Road, Garh Road, Hapur Road and Modipuram-side approaches carry high traffic volumes and serve both intra-city and regional movements. Mixed traffic conditions, roadside activities, parking spillover, weak pedestrian infrastructure and informal stopping patterns contribute to travel-time delays and congestion.

The central city and commercial areas generate high pedestrian and intermediate public transport demand. Educational institutions, hospitals, markets and industrial areas further contribute to trip generation. The city's mixed land-use pattern creates short- and medium-distance trips that are often served by informal modes. While such modes provide flexibility, they also create traffic conflicts when not properly organized around major roads and station areas.

The existing public transport system is limited in its ability to provide a structured city-wide alternative to private vehicles. This has increased dependence on two-wheelers, shared autos and e-rickshaws. RRTS can provide a strong trunk mobility corridor, but the surrounding city network must support station access through feeder routes, pedestrian improvements and managed interchange points.

RRTS as a City-Wide Mobility Intervention

The Delhi–Ghaziabad–Meerut RRTS is not only a regional transport project; it also has important implications for Meerut's urban mobility structure. The corridor improves regional access between Delhi, Ghaziabad and Meerut and reduces the perceived distance between Meerut and the National Capital Region. At the same time, the presence of RRTS stations within the city creates new accessibility nodes that can restructure local movement patterns.

The RRTS operates as a high-speed mobility spine passing through the city. Stations such as Meerut South, Begumpul and Modipuram can influence travel behavior by attracting commuters from surrounding localities and encouraging public transport use for regional trips. If supported by efficient feeder services, station-area access and pedestrian infrastructure, the system can reduce dependence on private vehicles for longer trips and improve overall travel efficiency.

Station Influence Analysis

The station influence analysis focuses on four important RRTS stations within Meerut city: Meerut South, Shatabdi Nagar, Begumpul and Modipuram.

Meerut South functions as a southern gateway station. It is significant for users entering Meerut from the Delhi side and for commuters from southern residential and peri-urban areas. Its planning priority includes feeder integration, organized pick-up and drop-off, safe pedestrian access and interchange management.

Shatabdi Nagar represents a residential and industrial catchment. It has relevance for worker movement, daily commuting, residential access and industrial travel. The key planning concern is to improve last-mile connectivity and strengthen feeder routes between residential and employment areas.

Begumpul is one of the most important city-core stations because of its relationship with commercial activities, business areas, markets and high pedestrian movement. It requires careful management of pedestrian flows, IPT stands, parking, traffic conflicts and public realm design. As a core-city station, Begumpul has strong potential to become a major interchange and urban mobility node.

Modipuram represents the northern catchment and terminal-side mobility structure. It serves northern residential areas, institutional uses and regional movement towards Muzaffarnagar side. Its planning priorities include terminal integration, feeder services, parking regulation, park-and-ride management and improved access to surrounding settlements.

Modal Shift and Public Transport Integration

The success of RRTS depends on its ability to attract users from private and road-based modes towards public transport. The project appraisal framework includes modal-shift assumptions from cars, two-wheelers, buses and rail. Such shifts are important because they can reduce road congestion, fuel consumption, emissions and travel-time uncertainty.

In Meerut, the modal shift potential is significant but conditional. Users may shift to RRTS for regional trips if the total journey becomes faster, safer, comfortable and economically reasonable. However, commuters will continue to depend on two-wheelers, autos and e-rickshaws if station access remains inconvenient. This indicates that RRTS alone cannot achieve full modal shift. It must be supported by organized feeder services, walkable station areas, regulated IPT stands, parking management and better information systems.

Issues and Gaps

The study identifies several issues that may constrain the urban mobility impact of RRTS in Meerut. The first issue is weak last-mile connectivity. Many station catchments depend on informal modes, and the absence of organized feeder routes can reduce the attractiveness of RRTS. The second issue is pedestrian discontinuity. Poor footpaths, unsafe crossings, encroachment and mixed traffic reduce the ease of reaching stations on foot.

The third issue is parking and IPT conflict. Without designated pick-up and drop-off spaces, auto stands, e-rickshaw holding zones and parking management, station areas may become new congestion points. The fourth issue is land use–transport mismatch. If station areas are not planned with suitable land-use integration, public realm improvement and density management, the benefits of RRTS may not translate into sustainable urban development.

Planning Recommendations

Based on the analysis, the study recommends a multi-level planning strategy for improving the impact of RRTS on Meerut's urban mobility.

First, a city-wide feeder integration plan should be developed. Feeder routes should connect residential areas, institutional clusters, industrial areas, commercial centers and bus / railway terminals with RRTS stations. E-rickshaws and shared autos should be organized through designated stands and regulated routes.

Second, pedestrian access to stations should be improved. This includes continuous footpaths, safe crossings, shaded walking routes, universal accessibility, lighting, wayfinding and removal of encroachments around station approaches.

Third, station-area management plans should be prepared for each station. Meerut South should be planned as a gateway and interchange station. Shatabdi Nagar should focus on worker and residential access. Begumpul should be developed as a pedestrian-priority city-core interchange. Modipuram should be planned as a terminal-side integration and park-and-ride location.

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