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# Simulation-Based Analysis of Traffic Incident Management with Dynamic Rerouting on Urban Arterials

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**Abstract - Urban traffic incidents such as accidents, breakdowns, and lane blockages significantly increase congestion on arterial roads by reducing capacity, increasing delays, lowering speeds, and forming long queues that spread to nearby intersections. This study evaluates incident management on the Chavadimukku-Overbridge corridor using Simulation of Urban MObility(SUMO)-based microscopic simulation integrated with Traffic Control Interface (TraCI), calibrated and validated with real traffic data. Incident scenarios were modeled through phased lane blockage and recovery, and three strategies were tested: Baseline (no rerouting), Reactive Rerouting, and Adaptive Reactive Rerouting. The Adaptive Reactive approach used Breadth First Search (BFS) to identify and reroute affected vehicles early. Results show that adaptive reactive strategy is better dispatching strategy compared to others, since it helps in reducing delay, queue length, travel time, and Vehicle Hours of Delay (VHD), while improving speed and throughput. The study concludes that adaptive dynamic rerouting is an effective tool for mitigating congestion during traffic incidents and can support real-time traffic management decisions.**

**Key Words: Traffic Incident Management, Dynamic Rerouting, Urban Arterials, Traffic Congestion**

## 1.INTRODUCTION

Urban traffic congestion has become a major issue in rapidly growing cities, and its impact becomes more critical when unexpected incidents such as accidents, vehicle breakdowns, or lane blockages occur [1]. These non-recurrent events reduce roadway capacity suddenly, leading to increased delay, queue formation, reduced speeds, and spillback effects that can extend to adjacent intersections and connected corridors. Such disruptions significantly affect corridor performance, especially during peak traffic conditions in urban arterial networks.

The basic principles of traffic behaviour are explained through classical traffic flow theory, which defines the relationship between speed, flow, and density under normal operating conditions [2]. However, these models are not sufficient to capture sudden and irregular disruptions caused by incidents. This limitation has led to the use of microscopic simulation tools such as SUMO, which allow detailed modelling of individual vehicle movements and congestion evolution under dynamic conditions [3].

Modern traffic management systems increasingly rely on intelligent transportation technologies for improving incident response. GIS-based modelling and simulation integrated with optimization techniques have been used to support better decision-making during emergency conditions [4]. Similarly, advancements in connected and autonomous vehicle systems have improved traffic efficiency by enabling faster communication and rerouting decisions during disruptions [5]. Real-time information-based systems also help in improving route distribution and reducing congestion formation in affected corridors [6].

Despite these advancements, most existing approaches do not integrate incident modelling, traffic rerouting, and response strategies within a single unified simulation framework. This creates a gap in evaluating how different traffic management strategies perform under consistent incident scenarios, especially in complex urban arterial corridors. Hence, a comprehensive simulation-based approach is required to analyse and compare these strategies effectively.

## 2. LITERATURE REVIEW

Traffic incident impacts and congestion propagation have been widely studied using traffic flow theory and shockwave analysis. Saxena et al. [7] explained how sudden reductions in road capacity generate backward-moving shockwaves that lead to queue formation and congestion buildup. Wu et al. [8] further demonstrated that these shockwaves propagate upstream, increasing delay and affecting network stability.

Simulation-based studies have been extensively used to analyse traffic behaviour under incident conditions. Smith et al. [9] used SUMO to evaluate how incidents increase congestion levels and delay in urban networks. Mitsakis et al. [10] highlighted the importance of combining dynamic traffic assignment with control systems to better represent real-time traffic variations. Liu et al. [11] developed a spatiotemporal model to predict how congestion spreads across urban road networks during incidents. In the area of incident response and optimization, Almohammad et al. [12] developed an automated framework to generate and evaluate incident response plans using microsimulation, helping improve recovery efficiency. Huang and Pan [4] demonstrated that integrating GIS with traffic simulation improves decision-making in incident management, Rerouting strategies have also been widely studied. Bilgram et al. [13] introduced proactive rerouting methods that identify affected vehicles in advance to reduce congestion formation. Wang et al. [14] proposed adaptive rerouting approaches that dynamically redistribute traffic based on congestion levels, improving network performance under varying conditions. Tay et al. [6] further showed that intelligent rerouting systems can significantly reduce congestion by adjusting routes in real time.

Recent studies also explore advanced technologies in traffic management. Sadeghi et al. [5] showed that connected and autonomous vehicles improve traffic efficiency during disruptions by enabling faster route adaptation. However, most studies still focus on either congestion modelling, rerouting, or incident response separately rather than integrating them into a single framework.

Overall, the literature shows strong progress in modelling traffic incidents and developing rerouting strategies, but there remains a lack of unified simulation frameworks that combine incident modelling, dynamic rerouting, and response evaluation for urban arterial corridors.

## 3. METHODOLOGY

This study adopts a microscopic traffic simulation-based approach for analysing traffic incident management with dynamic rerouting on urban arterial roads using the SUMO platform. The Chavdimukku–Overbridge corridor was selected as the study area, representing a typical urban arterial section with high traffic demand and recurring congestion during peak hours.

The required traffic and geometric data were collected from Integrated Command and Control Centre (ICCC) records, supported by field surveys and satellite imagery obtained from Google Earth Pro. The spatial layout of the corridor was digitized and processed using QGIS to ensure accurate representation of road geometry, lane configuration, and intersection characteristics.

The developed GIS-based network was then imported into SUMO for simulation modelling. The network was refined by defining nodes, links, traffic demand patterns, and signal control parameters to replicate real-world traffic operations. Traffic flow inputs were assigned based on observed volume data to ensure realistic simulation conditions. The methodology framework is shown in Chart-1.

Model calibration and validation were performed to ensure the reliability of the simulation output. Calibration involved adjusting behavioural and demand parameters to match observed field conditions, while validation was carried out using the GEH statistic and coefficient of determination ($R^2$) to confirm the accuracy of simulated traffic flows

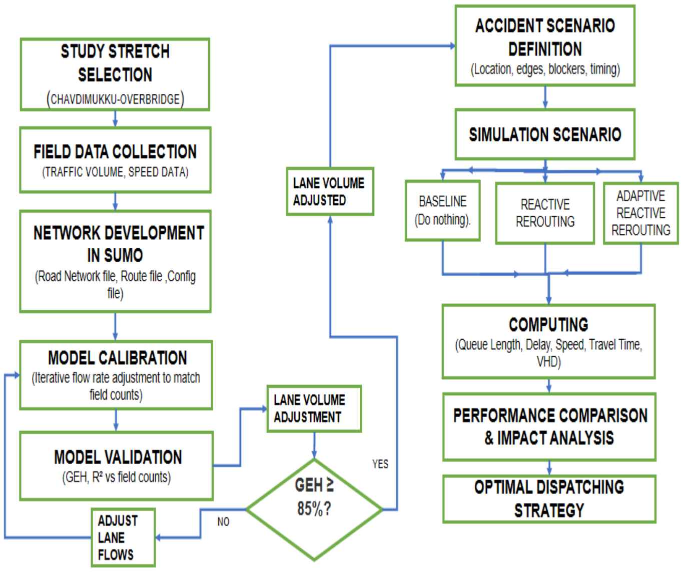


**Chart-1**: Methodology Framework

Incident scenarios were introduced by implementing phased lane blockage and recovery conditions to replicate real-world traffic disruptions caused by accidents or lane closures. The impact of these incidents was evaluated under three traffic management strategies: Baseline (No Rerouting), Reactive Rerouting, and Adaptive Reactive Rerouting.

The rerouting mechanism was implemented using the Traffic Control Interface (TraCI), enabling real-time interaction with the simulation environment. In the Reactive strategy, rerouting decisions were executed after congestion formation, whereas the Adaptive Reactive strategy dynamically redistributed traffic based on upstream conditions and available network capacity to prevent congestion propagation.

The performance of each scenario was evaluated using key traffic performance indicators, including travel time, average delay, queue length, vehicle speed, and Vehicle Hours of Delay (VHD). Comparative analysis of these measures was carried out to assess the effectiveness of each strategy in mitigating incident-induced congestion and improving overall corridor performance.

### 3.1 Model Calibration

Model calibration is an essential step in simulation studies to ensure that the model represents real-world traffic conditions accurately. In this study, the SUMO model for the Chavdimukku–Overbridge corridor was calibrated by iteratively tuning key input parameters until the simulated traffic volumes closely matched the observed field data. This process was continued until a satisfactory agreement between observed and simulated flows was achieved across the major road segments.

The percentage error between observed and simulated traffic volumes was then evaluated and found to be within acceptable limits. Similar consistency was observed across connected road sections, confirming that the calibration process effectively aligned the model with real traffic conditions. Overall, the calibrated model was found to reliably represent existing traffic behaviour and is suitable for further simulation and incident analysis.

### 3.1 Model Validation

Model validation is carried out to confirm that the calibrated simulation model accurately represents real-world traffic conditions using independent data sets. In this study, validation was performed by comparing additional observed traffic volumes with simulated outputs from the SUMO model for the Chavdimukku–Overbridge corridor. The results showed a good agreement between observed and simulated flows for both the main corridor and connected road network, indicating that the model maintains consistency beyond the calibration dataset. The validation performance was assessed using GEH statistics and R² values. The GEH values were found to be within acceptable limits for most of the links, with more than 85% of the values satisfying standard criteria. The R² values of 0.99 as shown in Chart -2 also indicated a strong correlation between observed and simulated traffic volumes, confirming good model reliability. Overall, the validation results confirm that the developed SUMO model can accurately replicate real-world traffic behaviour and is reliable for simulating incident scenarios and evaluating different traffic management and rerouting strategies.

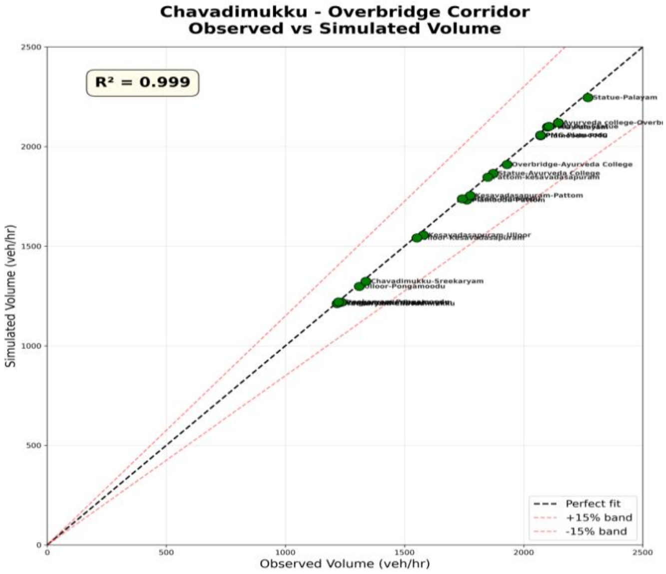


**Chart -2:** Validation graph

### 3.2 Accident Scenario Creation

The accident scenario in this study is developed in SUMO to realistically represent how a traffic incident affects movement along an urban arterial corridor. Based on field data collection and interactions with local traffic police, incident clearance times were categorized to inform the simulation parameters. Observations indicate that minor accidents are typically resolved within 5 to 10 minutes, whereas major incidents require a maximum of 30 to 35 minutes for complete clearance. Furthermore, such incidents can cause complete blockage of a road segment (edge) for approximately 5 to 10 minutes. To accurately model a worst-case scenario for evaluating the dynamic rerouting strategy, an incident duration of 35 minutes was selected for the simulation. This parameter is directly supported by real-world observations, such as a documented bus breakdown that occurred at 8:30 AM, underwent repairs starting at 8:45 AM, and was finally cleared when the bus restarted at 9:05 AM, confirming the 35-minute major incident time frame.

The simulation is divided into four time phases to clearly capture normal traffic conditions, the occurrence of the incident, the recovery process, and the return to normal operations. The first phase (0–900 seconds) represents normal traffic flow, where vehicles move without any disturbance and the corridor operates at its regular capacity.

At 900 seconds, an incident is introduced at the selected location, marking the start of the second phase (900–1500 seconds). During this period, the affected section is completely blocked, with all lanes closed and vehicle speeds reduced to zero. This creates a sudden disruption in traffic flow, leading to congestion and queue formation upstream of the incident location.

The third phase (1500–3000 seconds) represents the recovery stage, where the blocked situation is gradually cleared. For the purpose of simulation, three roadway conditions are considered: single lane, two lane, and three lane sections. The stretches considered for simulation which is, within the Chavadimukku-Overbridge Corridor are shown in Fig-1. In the single lane section, partial movement is allowed at very low speeds. In the two lane and three lane sections, one lane remains closed while the other lanes are reopened for traffic movement, but vehicles continue to travel at reduced speeds due to the ongoing recovery and residual congestion. This staged approach helps in realistically representing how traffic slowly returns to normal after an incident.

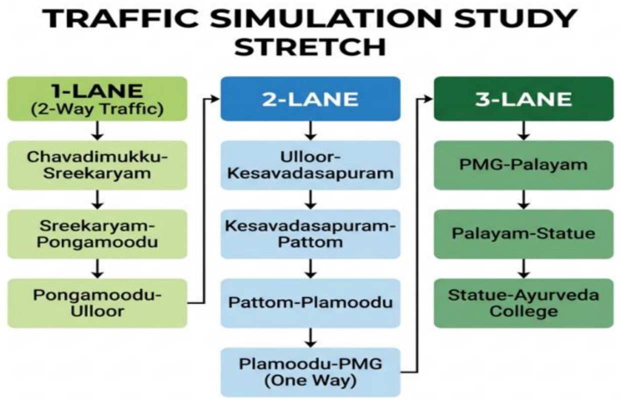


**Fig-1.** Stretches Used for the study

### 3.4 Simulation Scenarios

The simulation scenario is developed using SUMO integrated with TraCI to evaluate different traffic management strategies under incident conditions on the Chavdimukku–Overbridge urban arterial corridor. The calibrated network and traffic demand are kept constant across all cases to ensure a fair comparison. The study simulates an accident scenario and analyses traffic performance under three strategies: Baseline, Reactive Rerouting, and Adaptive Reactive Rerouting.

**Baseline (No Rerouting):**

In this case, vehicles follow predefined routes without any modification during incidents. No traffic control or rerouting is applied, making it a reference case that represents normal driver behaviour under congestion conditions.

**Reactive Rerouting:**

Here, vehicles are dynamically rerouted only after congestion is detected. Route changes are triggered based on indicators such as speed reduction, queue formation, and increased travel time. This represents a corrective strategy applied after congestion begins.

**Adaptive Reactive Rerouting (Severity-Based):**

This approach improves upon reactive rerouting by incorporating real-time traffic conditions, congestion severity, lane blockage, and upstream traffic demand. It enables earlier and more efficient rerouting decisions to reduce congestion propagation. To support this, a Breadth First Search (BFS) based graph approach is used to identify upstream affected links from the incident location. The road network is modelled as a graph with intersections as nodes and road segments as edges. BFS helps in detecting potentially affected upstream zones, enabling early rerouting decisions before vehicles enter the congestion area, thereby improving traffic distribution during incident conditions.

## 3. RESULTS AND DISCUSSIONS

### 3.1. Incident at Single-lane

The performance of Baseline (No Rerouting), Reactive Rerouting, and Adaptive Reactive Rerouting strategies was evaluated for the Chavadimukku–Sreekaryam, Sreekaryam–Pongamoodu, and Pongamoodu–Ulloor segments under incident conditions. A segment-wise analysis of queue length, delay, speed, throughput, travel time, and level of service is presented below.

The multidimensional performance analysis of traffic management strategies is shown in Chart 3. It provides a radar-based comparison of key performance measures such as travel time, VHD, delay, and maximum queue length across the three strategies for all the single-lane corridor cases. From the comparison, it is clear that the Baseline condition consistently performs the worst, with the highest congestion levels reflected in longer queues, higher delays, increased VHD, and unstable travel time. The Reactive strategy shows some improvement over the baseline by reducing these values, but the improvement remains limited because the response to incidents is not immediate and congestion has already started to build up. On the other hand, the Adaptive Reactive strategy stands out clearly across all indicators. It consistently records the lowest queue lengths, reduced delays and VHD, and more stable travel time behaviour across all segments. Overall, the radar pattern strongly suggests that Adaptive Reactive rerouting provides a more balanced and efficient traffic distribution compared to the other two strategies, making it the most effective approach under incident conditions.

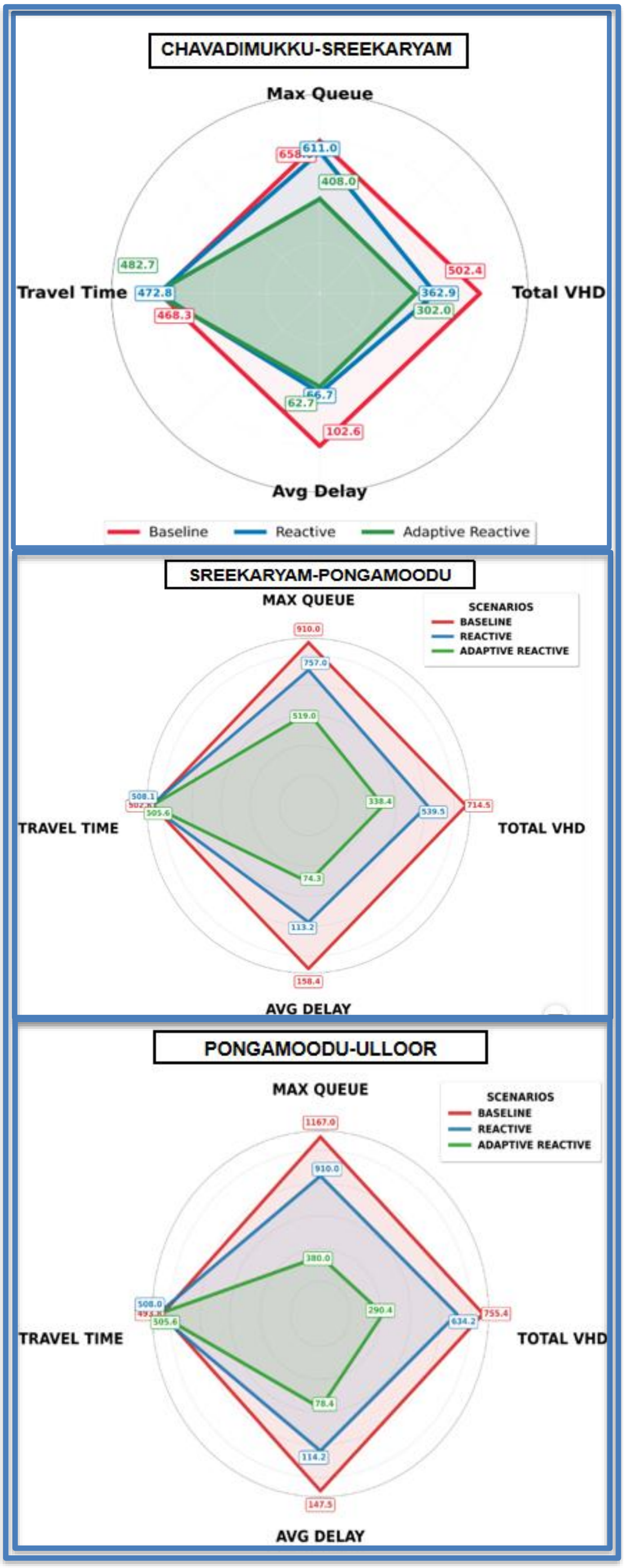


**Chart-3.** Multi-Dimensional Performance Analysis of Traffic Management Strategies in single-lanes

In the Chavadimukku–Sreekaryam segment, the Baseline condition led to severe congestion, with a queue length of 658 vehicles (4.9 km), very low speeds of 7.85 m/s, and high delays exceeding 102 seconds per vehicle, resulting in LOS F. The Reactive strategy offered only partial relief, bringing the queue down slightly to 611 vehicles (4.58 km) and improving speeds to 14.3 m/s, shifting the condition to LOS E. However, congestion was still quite evident due to the delayed nature of rerouting. The Adaptive Reactive strategy performed much better, reducing the queue to 408 vehicles (3 km), which is a 38% reduction compared to the baseline, while increasing speeds to 20.69 m/s. In terms of travel time, a slight increase was observed in both Reactive and Adaptive strategies compared to the baseline, which can be understood as a result of rerouting vehicles through alternative paths to avoid heavily congested areas, thereby improving overall traffic stability rather than focusing only on shortest travel time.

A similar pattern is observed in the Sreekaryam–Pongamoodu segment, where congestion becomes more severe due to upstream spillback effects. Under the Baseline condition, the queue reached 910 vehicles (6.8 km), with delays of 158.4 seconds per vehicle, resulting in LOS F. The Reactive strategy reduced the queue slightly to 757 vehicles (5.6 km), but the corridor still remained heavily congested. The Adaptive Reactive strategy showed a much stronger improvement, reducing the queue to 519 vehicles (3.89 km), a 43% reduction compared to the baseline, and cutting delays nearly by half to 74.3 seconds per vehicle. Here again, travel time showed a slight increase under both rerouting approaches, which reflects the trade-off between rerouting decisions and overall network efficiency, where stability is prioritised over individual path minimisation.

In the Pongamoodu–Ulloor segment, which functions as a terminal junction, the Baseline scenario showed the worst performance with a queue length of 1,167 vehicles (8.75 km), delays of 147.5 seconds per vehicle, and complete gridlock conditions (LOS F). The Reactive strategy provided only limited improvement, reducing the queue to 910 vehicles (7.17 km), while congestion still remained severe. The Adaptive Reactive strategy significantly improved the situation by bringing the queue down to 380 vehicles (3.7 km), achieving a 67.4% reduction compared to the baseline. Speeds increased to 26.4 m/s, and delays reduced to 78.4 seconds per vehicle. Unlike the upstream sections, travel time in this segment also improved noticeably under the Adaptive Reactive strategy due to better dissipation of congestion and smoother movement towards the downstream end.

Overall, the results across all segments clearly show that single-lane arterial corridors are highly sensitive to incident conditions and tend to experience rapid congestion build-up and shockwave propagation. While Reactive rerouting offers only limited improvement after congestion begins, the Adaptive Reactive strategy consistently performs better by proactively redistributing traffic and preventing severe queue formation. Across all cases, it leads to lower congestion, reduced delays, improved speeds, and more stable travel time behaviour. This makes Adaptive Reactive rerouting the most effective and practically suitable strategy for managing incident conditions in single-lane arterial corridors.

### 3.2 Incident at 2-lane

The performance of Baseline (No Rerouting), Reactive Rerouting, and Adaptive Reactive Rerouting strategies was evaluated for the Ulloor–Kesavadasapuram, Kesavadasapuram–Pattom, Pattom–Plamoodu, and Plamoodu–PMG segments under incident conditions. A segment-wise analysis of queue length, delay, speed, throughput, travel time, and level of service is presented below.

The multidimensional performance analysis of traffic management strategies is shown in Chart 4, comparing travel time, VHD, delay, and maximum queue length across all two-lane corridor segments. The results clearly indicate that the Baseline condition performs the worst, with consistently higher congestion, longer queues, increased delays, higher VHD, and unstable travel time. The Reactive strategy provides only limited improvement since it responds after congestion has already developed. In contrast, the Adaptive Reactive strategy shows the best overall performance across all indicators, with reduced queues, lower delays and VHD, improved throughput, and more stable travel time behaviour, confirming its effectiveness in managing incident conditions in two-lane arterial corridors.

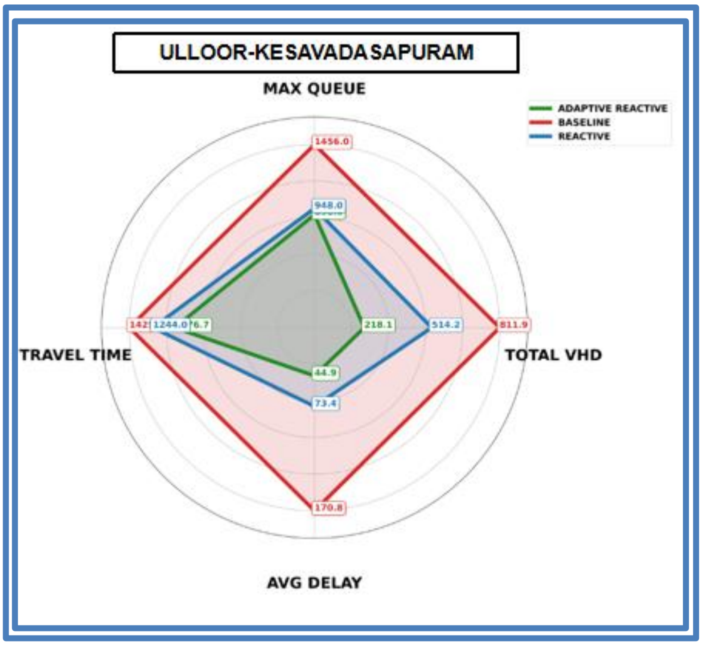
In the Ulloor–Kesavadasapuram segment, the Baseline condition produced severe congestion due to heavy inflow from Ulloor combined with a 50% capacity reduction. The queue length reached 1,456 vehicles with delays of 170.8 seconds per vehicle, resulting in LOS F conditions. The Reactive strategy provided moderate improvement by reducing the queue to 948 vehicles and delay to 73.4 seconds, shifting the operation to LOS E. The Adaptive Reactive strategy performed better by further reducing the queue to 898 vehicles and lowering delay to 44.9 seconds, while increasing average speed to 25.1 kph, improving the segment to LOS D.

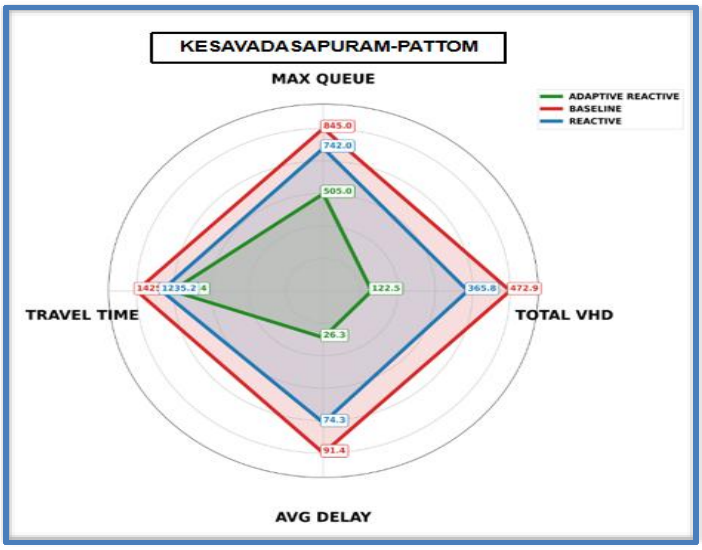
A similar trend is observed in the Kesavadasapuram–Pattom segment, where the Baseline condition recorded a queue of 845 vehicles with delays of 91.4 seconds per vehicle, resulting in LOS F due to merging friction. The Reactive strategy reduced the queue to 742 vehicles, but performance remained in LOS F with delays of 74.3 seconds. The Adaptive Reactive strategy significantly improved conditions by reducing the queue to 505 vehicles (nearly 40% reduction), lowering delay to 26.3 seconds, and increasing speed to 27.0 kph, thereby achieving LOS D.

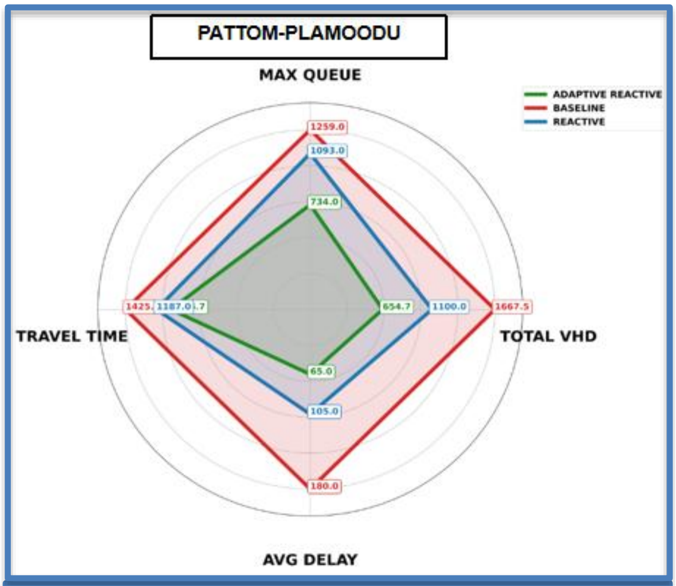
In the Pattom–Plamoodu segment, congestion intensified due to downstream spillback effects. The Baseline scenario recorded a queue of 1,259 vehicles and delay of 180 seconds per vehicle, indicating LOS F conditions. The Reactive strategy reduced the queue to 1,093 vehicles and delay to 105 seconds, improving performance to LOS E. The Adaptive Reactive strategy showed stronger improvement by reducing the queue to 734 vehicles (41.7% reduction) and delay to 65 seconds, achieving LOS D.

In the Plamoodu–PMG segment, which serves as a major urban approach corridor, the Baseline condition again showed severe congestion with a queue of 1,359 vehicles and delays of 180 seconds per vehicle, resulting in LOS F. The Reactive strategy improved conditions moderately by reducing the queue to 1,050 vehicles and delay to 105 seconds, shifting performance to LOS E. The Adaptive Reactive strategy delivered the best performance by reducing the queue to 792 vehicles, lowering delay to 65 seconds, and improving average speed to 24.2 kph, thereby achieving LOS D.

Overall, the results across all four segments clearly show that two-lane arterial corridors experience severe congestion under incident conditions due to spillback and merging effects. While Reactive rerouting provides only partial improvement after congestion develops, the Adaptive Reactive strategy consistently performs better by proactively redistributing traffic and preventing excessive queue formation. Across all segments, it achieves significant reductions in queue length and delay, improves speed and throughput, and maintains more stable travel time performance. This clearly indicates that Adaptive Reactive rerouting is the most effective strategy for managing incident-induced congestion in two-lane arterial corridors.







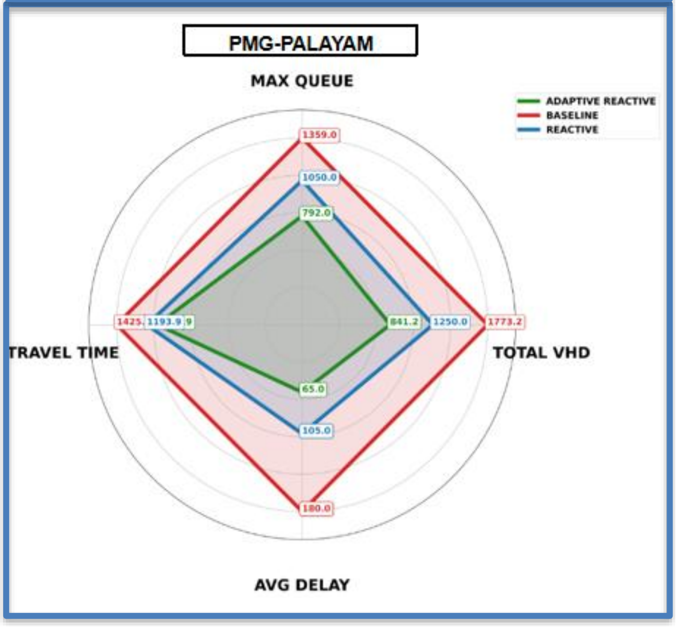


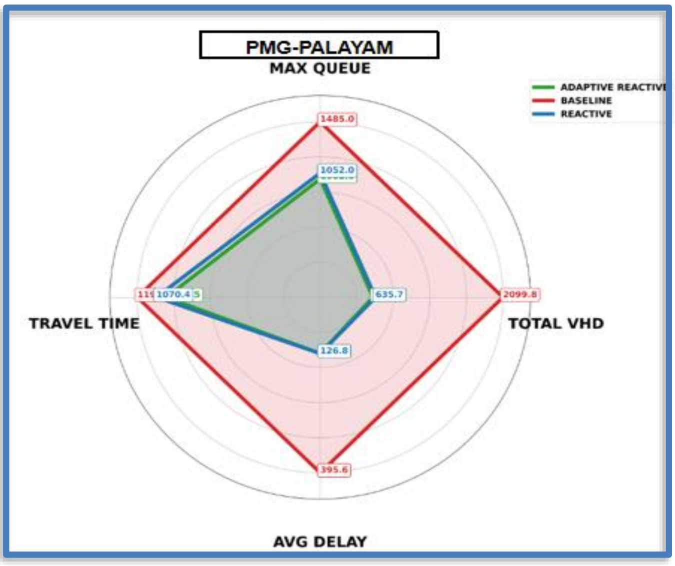
**Chart-4.** Multi-Dimensional Performance Analysis of Traffic Management Strategies in 2-lanes

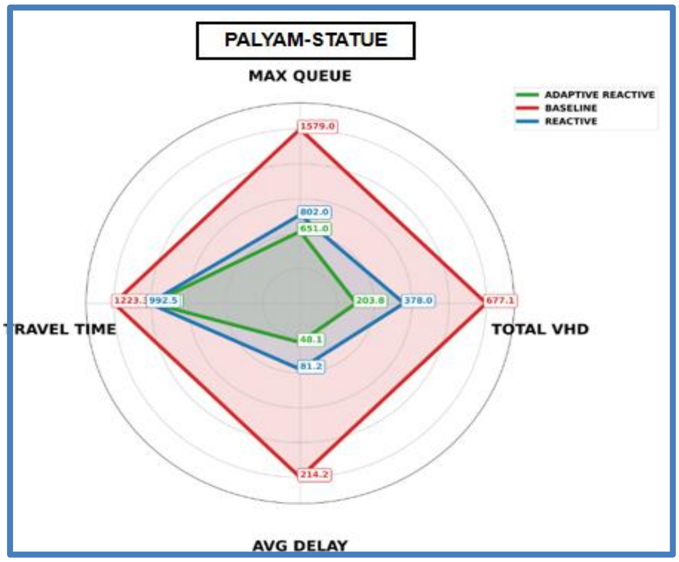
### 3.3 Incident at 3-lane

The performance of Baseline (No Rerouting), Reactive Rerouting, and Adaptive Reactive Rerouting strategies was analysed for the PMG–Palayam, Palayam–Statue, and Statue–Ayurveda College segments under incident conditions. The multidimensional performance analysis of traffic management strategies is shown in Chart 5, comparing travel time, VHD, delay, and maximum queue length across all three-lane corridor segments. The results clearly indicate that the Baseline condition performs the worst, with severe congestion, long queues, high delays, increased VHD, and unstable travel time, especially near the incident-affected sections. The Reactive strategy shows noticeable but limited improvement, as it reduces congestion only after it has already formed and partially propagated through the corridor. In contrast, the Adaptive Reactive strategy consistently demonstrates the best performance across all indicators, with significant reductions in queue length, delay, and VHD, along with improved throughput and more stable travel time behaviour. This confirms its effectiveness in efficiently managing incident conditions in three-lane urban arterial corridors.

In the PMG–Palayam segment, the Baseline condition resulted in severe congestion due to heavy inflow towards the urban core combined with reduced effective capacity after the incident. The queue length reached 1,485 vehicles, and the average delay increased sharply to 395.5 seconds per vehicle, leading to complete breakdown conditions (LOS F). The Reactive strategy provided partial relief by reducing the queue to 1,052 vehicles and lowering delay to 126.8 seconds, shifting the operation to LOS E. However, congestion was still prominent, indicating that reactive intervention was not sufficient to fully recover traffic stability once queues had already formed. The Adaptive Reactive strategy showed further improvement by reducing the queue to 1,002 vehicles (around 32% reduction from baseline). Although the delay remained nearly similar to the Reactive case, the key improvement was in controlling congestion growth and preventing widespread spillback. This ensured that congestion remained spatially confined near the incident location instead of spreading along the corridor.

In the Palayam–Statue segment, congestion levels were also high under Baseline conditions, with a queue of 1,579 vehicles and a delay of 214.2 seconds per vehicle, resulting in LOS F. The Reactive strategy significantly improved operations by reducing the queue to 802 vehicles and delay to 81.2 seconds, shifting the segment to LOS D. The Adaptive Reactive strategy performed even better by reducing the queue further to 651 vehicles, representing nearly a 59% reduction compared to the baseline. Delay dropped sharply to 48 seconds, while speed improved noticeably, allowing the segment to operate under LOS C conditions. This demonstrates that adaptive control not only reduces congestion intensity but also improves flow stability, leading to smoother and more continuous traffic movement through the corridor.





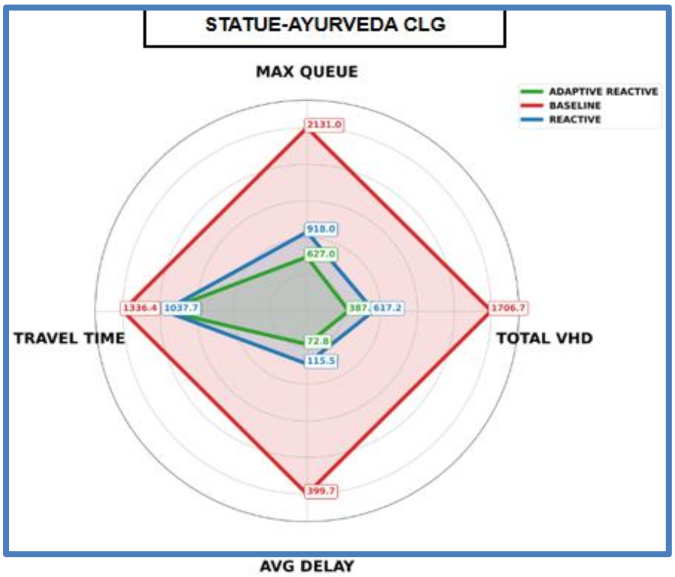


**Chart-5.** Multi-Dimensional Performance Analysis of Traffic Management Strategies in 3-lanes

In the Statue–Ayurveda College segment, which serves as a critical downstream urban approach, the Baseline scenario experienced the most severe congestion among all three-lane segments. The queue length reached 2,131 vehicles, and delay approached 400 seconds per vehicle, indicating complete system breakdown under LOS F conditions. The Reactive strategy reduced congestion substantially, bringing the queue down to 918 vehicles and delay to 115.5 seconds, improving the system to LOS E. However, congestion was still significant due to strong spillback effects from upstream segments. The Adaptive Reactive strategy delivered the highest level of improvement by reducing the queue to 627 vehicles, achieving nearly a 70% reduction compared to baseline. Delay also reduced significantly to 72.8 seconds, and the segment operated under stable LOS C conditions. This shows that adaptive rerouting was highly effective in controlling congestion propagation and preventing corridor-wide breakdown, particularly in highly sensitive urban sections.

Overall, the results clearly show that while three-lane corridors provide better operational flexibility compared to narrower road types, incident conditions still create substantial congestion due to forced merging, capacity reduction, and high directional demand towards urban centres. The Baseline scenario consistently resulted in severe congestion and LOS F conditions across all segments. The Reactive strategy provided moderate improvement by reducing some of the congestion after it had formed, but its effectiveness remained limited in preventing spillback and long queue formation. In contrast, the Adaptive Reactive strategy consistently outperformed both approaches by dynamically redistributing traffic based on evolving congestion conditions. It effectively reduced queue lengths, significantly lowered delays, improved speeds, and maintained more stable traffic flow across the corridor.

Across all segments, the improvements were substantial, with queue reductions reaching up to 70%, notable reductions in delay, and clear improvements in Level of Service from F to E and even C in critical sections. The results confirm that Adaptive Reactive rerouting is the most effective strategy for managing incident-induced congestion in three-lane urban arterial corridors, as it not only mitigates congestion severity but also ensures better spatial distribution and overall corridor stability under high-demand urban traffic conditions.

## 4. CONCLUSIONS

Urban traffic incidents such as accidents, vehicle breakdowns, and lane blockages significantly disrupt traffic flow on arterial roads, especially during peak hours. These events reduce roadway capacity, increase delays, lower speeds, and create long queues that often extend to nearby intersections. This study uses a microscopic simulation model developed in SUMO to analyse incident impacts and evaluate rerouting strategies. Three strategies were compared: Baseline (No Rerouting), Reactive Rerouting, and Adaptive Reactive Rerouting. Results for single-, two-, and three-lane corridors showed that the Baseline scenario performed worst, with severe congestion and poor Level of Service. Single-lane roads were most affected due to lack of overtaking, while two-lane roads experienced merging conflicts. Three-lane roads performed better but still faced congestion under high demand. The Reactive strategy showed limited improvement under heavy traffic, whereas the Adaptive Reactive strategy performed best by dynamically redistributing traffic based on real-time conditions and available capacity. It significantly reduced delay, queue length, travel time, and Vehicle Hours of Delay (VHD), while improving speeds and overall throughput. Overall, the Adaptive Reactive approach was identified as the optimal dispatching strategy for incident management. The study confirms that adaptive rerouting improves traffic resilience during incidents and provides a practical simulation-based framework for reducing congestion and improving urban mobility.

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