Tactical Urbanism for Road Safety Improvement at Dahi Chauki Intersection, Unnao, Uttar Pradesh: A Before–Design–After Case Study

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***Abstract*—Tactical urbanism provides a rapid, low-cost and reversible method for testing road-safety treatments before committing to permanent civil works. This paper presents a case-study framework for the application of tactical urbanism at Dahi Chauki intersection in Unnao, Uttar Pradesh, a complex junction carrying through traffic, local access traffic, heavy vehicles, two-wheelers, auto-rickshaws and substantial pedestrian activity. The study uses a before–design–after structure supported by aerial imagery and a three-dimensional intervention plan. The existing condition indicates a large and loosely defined conflict area, multiple turning paths, roadside activity, heterogeneous traffic and pedestrian exposure. The tactical design reorganizes the intersection through lane channelization, high-visibility pedestrian crossings, painted safety zones, stop/slow markings, traffic-calming bars, delineation, median/refuge treatments and a yellow box intended to discourage intersection blocking. The post-implementation image shows the physical translation of several of these measures into the road environment. The paper develops a practical evaluation methodology based on speed, traffic volume, pedestrian movement, conflict observations, queueing, compliance and crash history. Because verified before-and-after numerical datasets were not supplied for this manuscript, the study deliberately avoids inventing quantitative crash-reduction or speed-reduction claims; instead, it identifies the indicators required for statistically defensible evaluation. The case demonstrates how tactical urbanism can function as an intermediate road-safety engineering stage: diagnose risk, deploy reversible measures, observe road-user behaviour, refine geometry and then convert successful elements into durable works.**

***Index Terms*—Tactical urbanism; road safety; black spot; Dahi Chauki; intersection design; traffic calming; pedestrian safety; conflict reduction.**

I. INTRODUCTION

Road-safety improvement at busy urban and peri-urban intersections is often constrained by limited right-of-way, mixed traffic, roadside commercial activity, uncertain turning behaviour and the time required to plan and construct permanent engineering works. At such locations, the interval between identifying a safety problem and completing a conventional capital project can leave road users exposed to known risks. Tactical urbanism offers a complementary approach: temporary or semi-permanent materials are used to alter the operating environment quickly, allowing engineers to test a design under real traffic conditions and to revise it before permanent construction.

In road-safety applications, tactical urbanism is not simply decorative placemaking. Its engineering value lies in making desired paths legible, narrowing excessively open paved areas, separating incompatible movements, shortening pedestrian exposure, managing turning radii, controlling stopping positions and increasing the visual prominence of crossings and conflict zones. Cones, modular separators, paint, bollards, delineators and temporary signs can therefore be used as a field-scale prototype of a future permanent junction.

Dahi Chauki provides a useful case because the intersection combines high-speed through movement with local access and crossing demand. The supplied aerial photographs show a broad divided road intersected by local approaches and intense roadside activity. Heavy vehicles, cars, auto-rickshaws, motorcycles and pedestrians occupy the same operational space. The geometric openness of the

junction can permit multiple vehicle trajectories, while pedestrians must negotiate several streams of traffic.
The objective of this paper is to document the tactical-urbanism approach at Dahi Chauki using the supplied before, proposed-design and post-implementation images; identify the principal safety functions of the measures; propose a rigorous monitoring framework; and set out a pathway for converting successful temporary treatments into permanent road-safety infrastructure.

II. STUDY AREA AND EXISTING CONDITIONS

Dahi Chauki is located in Unnao district, Uttar Pradesh, within a corridor influenced by inter-city and local traffic. The junction serves through traffic as well as movements to adjoining settlements, commercial frontage and local streets. This creates a transition from corridor operation to junction activity, where speed differentials and crossing movements become especially important.
The pre-intervention aerial image (Figure 1) indicates a large central open area and several possible vehicle paths. The principal divided carriageway carries buses, trucks, cars and two-wheelers, while local roads feed traffic into the junction. Auto-rickshaw activity and roadside stopping are also visible. Such an environment can generate crossing, merging, diverging and weaving conflicts, particularly when lane guidance and priority are not visually self-explaining.

Figure 1. Existing condition of Dahi Chauki intersection before tactical urbanism intervention.

2.1 Road-safety issues identified from the site imagery
• Large unchannelized or weakly channelized paved conflict area, allowing variable vehicle trajectories.
• Interaction between high-speed through traffic and slower local traffic, including auto-rickshaws and two-wheelers.
• Pedestrian crossing demand across wide carriageways and multiple traffic streams.

• Roadside commercial and stopping activity close to the junction, potentially affecting visibility and lane discipline.
• Turning and merging movements that require clearer guidance, deflection and priority control.
• Potential for intersection blocking when vehicles enter the central area without adequate downstream discharge space.

III. TACTICAL URBANISM DESIGN CONCEPT

The proposed intervention treats the junction as a system of conflict zones rather than as a single open paved space. The design shown in Figure 2 uses markings, colored edge treatments, crossings, channelizing elements and speed-management markings to make the intended road-user behaviour visually explicit. The design philosophy is to reduce ambiguity first, then reduce exposure and speed at the remaining conflict points.

Figure 2. Proposed tactical urbanism and traffic-calming design for Dahi Chauki.

3.1 Lane channelization and path definition

Lane arrows, edge lines, separators and painted buffer areas define the desired paths through the junction. This is particularly important in heterogeneous traffic because drivers and riders may otherwise select short, diagonal or overlapping trajectories. Channelization can reduce the number of simultaneous decisions required at the conflict area and can make yielding and merging locations more predictable.

3.2 Pedestrian crossings and refuge

High-visibility zebra crossings are positioned across approaches where pedestrian demand is expected. The design also uses islands or protected areas to divide a long crossing into shorter stages. For vulnerable users, the safety benefit of a refuge is not merely a reduction in distance; it also reduces the number of traffic streams that must be judged at one time. Crossings should ultimately be supported by adequate lighting, accessible kerb transitions and unobstructed sight distance.

3.3 Speed management

Repeated transverse markings and conspicuous approach treatments provide visual warning that drivers are entering a conflict-intensive zone. The operational objective is a lower and more consistent approach speed, not abrupt braking at the crossing

itself. Where field measurements show excessive speeds after the pilot, the permanent design may require stronger engineering measures such as raised tables, geometry-based deflection, rumble treatments where appropriate, or enforcement-supported speed management.

3.4 Yellow box and junction discipline

The central yellow cross-hatched box makes the conflict area visually prominent and communicates that vehicles should not occupy the junction unless an exit is available. At a large junction, queue spillback can transform ordinary turning conflicts into gridlock and can obstruct pedestrian movement. The box treatment should therefore be paired with suitable signs, enforcement and public communication where required.

3.5 Edge protection and tactical materials

Colored edge zones, cones, bollards or modular separators can reclaim portions of excessive carriageway and discourage informal parking or corner cutting. Because these elements are reversible, their alignment can be adjusted after observing truck swept paths, bus operation, emergency access and pedestrian behaviour. This iterative property is one of the strongest advantages of tactical urbanism over immediate permanent construction.

IV. METHODOLOGY FOR BEFORE–AFTER EVALUATION

A journal-quality evaluation should combine crash history with surrogate safety indicators and operational observations. Crash data alone may require a long observation period and can be affected by regression-to-the-mean, exposure changes and reporting quality. Therefore, a short-term tactical pilot should also be assessed using speeds, conflicts, pedestrian behaviour, compliance and traffic performance.

Table 1. Recommended monitoring framework for the Dahi Chauki tactical-urbanism pilot.

Indicator	Before survey	After survey	Purpose
Vehicle speed	Approach speed by vehicle class	Same locations/time periods	Assess speed reduction and dispersion
Traffic volume	Classified turning counts	Matched-day classified counts	Control for exposure and demand changes
Pedestrians	Crossing count and path mapping	Repeat observation	Measure crossing concentration and compliance
Traffic conflicts	Video-based conflict coding	Repeat coding	Assess near-crash interactions
Queue/delay	Queue length and control delay	Repeat during peak periods	Check operational side effects
Compliance	Lane, stop-line and box compliance	Repeat observation	Assess legibility of the design
Crashes	Multi-year police/department records	Post-treatment monitoring	Assess long-term safety performance

4.1 Survey design

Before and after surveys should be conducted on comparable weekdays, avoiding unusual weather, festivals, construction diversions or enforcement campaigns unless those conditions are part of normal operation. Video coverage should capture all approaches and the full conflict area. Speed measurements should be taken sufficiently upstream of the junction and again near the conflict zone so that the speed profile, rather than a single spot speed, can be examined.

4.2 Conflict analysis

Traffic-conflict analysis is especially valuable during a temporary intervention because it can reveal changes before sufficient post-treatment crash data

accumulate. Conflicts may be classified by movement type—crossing, merging, rear-end, pedestrian-vehicle and wrong-way or unexpected manoeuvre—and by severity using a consistent observable criterion such as time-to-collision or post-encroachment time when video quality permits. The same coding rules must be used for both periods.

4.3 Statistical treatment

For speeds, the analysis should report mean, median and 85th-percentile values by approach and vehicle class, together with sample size and dispersion. For counts and conflicts, rates should be normalized by traffic or pedestrian exposure where appropriate. If adequate crash data and suitable comparison sites are available, an empirical-Bayes or comparison-group approach is preferable to a simple before–after crash count because it better accounts for background trends and regression-to-the-mean.

V. IMPLEMENTATION AND OBSERVED PHYSICAL OUTCOME

The post-implementation aerial image in Figure 3 shows that the tactical concept was translated into a visibly structured junction. The central area is marked with yellow cross-hatching; pedestrian crossings are prominent; red/colored edge treatments and channelizing features define boundaries; and the approaches contain repeated transverse markings and lane guidance. Compared with the existing-condition image, the intersection presents a more explicit visual hierarchy of through movement, crossing zones and edge space.

Figure 3. Dahi Chauki intersection after implementation of tactical urbanism measures.

Figure 3 also illustrates why post-installation monitoring is essential. Large trucks continue to use the junction, roadside commercial activity remains present, and pedestrians and two-wheelers continue to interact with motor traffic. A successful tactical project should not be judged solely by the presence of markings; it should be judged by whether those markings and separators produce safer trajectories,

lower approach speeds, more orderly yielding and fewer severe conflicts without creating unacceptable queues or new hazards.

VI. RESULTS FRAMEWORK AND INTERPRETATION

The visual evidence supports a qualitative finding that the treatment substantially increases spatial definition at the junction. However, the photographs alone cannot establish a numerical reduction in crashes, speeds or conflicts. No verified before-and-after datasets were supplied with the present manuscript. Accordingly, this paper does not assign invented percentages to safety improvement. This distinction is important for publication quality: visual improvement is evidence of implementation, whereas safety effectiveness requires measured outcomes.

The expected mechanisms can nevertheless be stated as testable hypotheses. First, stronger channelization should reduce trajectory variability and lateral conflict. Second, high-visibility crossings and refuge areas should concentrate pedestrian movement at more predictable locations. Third, visual narrowing and transverse approach treatments should encourage earlier speed adjustment. Fourth, a clearly marked central box should discourage stationary queues within the primary conflict area. Fifth, edge protection should reduce corner cutting and informal occupation of pedestrian space.

VII. DISCUSSION

The Dahi Chauki case illustrates a useful shift in black-spot management from a binary choice between 'do nothing' and 'construct the final project' toward an iterative engineering process. A tactical treatment can be deployed quickly after diagnosis, monitored under real traffic, modified where problems appear and then formalized. This reduces the risk of locking an untested geometric concept into permanent concrete and kerbs.

For Indian mixed-traffic conditions, this iterative approach is particularly relevant. Vehicle dimensions, informal stopping, pedestrian route choice and two-wheeler filtering can reveal operational issues that are difficult to capture fully in drawings or conventional capacity analysis. A temporary layout allows engineers to observe actual swept paths and behavioural adaptation. At the same time, tactical materials must be maintained carefully: displaced cones, faded paint or poorly anchored separators can reduce effectiveness and may themselves become hazards.

The case also demonstrates that tactical urbanism should be integrated with conventional road-safety engineering rather than treated as a substitute for it. Drainage, pavement condition, lighting, sight distance, signs, delineation, median design, access control and enforcement remain necessary. Where the pilot confirms the geometry, permanent works should use crashworthy and standards-compliant materials appropriate to the road class and operating speed.

VIII. RECOMMENDATIONS FOR PERMANENT TREATMENT

- Retain only those tactical elements that are supported by measured behavioural and operational improvement.
- Convert successful painted/refuge areas into permanent, physically protected islands with appropriate visibility and crashworthy details.
- Provide durable high-visibility pedestrian crossings, accessible kerb ramps and lighting at confirmed crossing desire lines.
- Review approach speed profiles and strengthen geometric speed management where visual measures alone are insufficient.
- Rationalize roadside access, stopping and parking close to the junction to protect sight distance and reduce friction.
- Check all permanent geometry using design-vehicle swept-path analysis, particularly for buses and heavy goods vehicles.
- Provide a maintenance plan for markings, signs, delineators and lighting, with responsibility and inspection frequency clearly assigned.
- Continue post-treatment crash and conflict monitoring and undertake a formal road-safety audit of the permanent scheme.

IX. LIMITATIONS

This manuscript is based on the supplied site photographs and design visualization. Exact geometric dimensions, traffic counts, spot-speed observations, pedestrian counts, conflict data and verified crash

records were not included in the material used to prepare this version. Consequently, the paper intentionally limits its conclusions to design interpretation and an evaluation framework. Prior to journal submission, the corresponding measured datasets should be inserted into the methodology and results sections, and the statistical analysis should be updated accordingly.

X. CONCLUSION

The Dahi Chauki case demonstrates how tactical urbanism can be applied as a rapid road-safety engineering prototype at a complex mixed-traffic junction. The before image shows an operationally open intersection with multiple potential trajectories and substantial interaction among through traffic, local traffic and pedestrians. The proposed design responds by organizing movements, highlighting pedestrian priority areas, managing approach behaviour and defining the central conflict zone. The post-implementation image confirms that these concepts were materially introduced at the site.

The principal value of the approach is its reversibility and measurability. Instead of assuming that a drawing will perform as intended, the road authority can observe real behaviour, modify the layout and convert successful elements into permanent infrastructure. For Dahi Chauki, the next stage should therefore be a structured before-and-after assessment using speed, conflict, pedestrian, traffic and crash indicators. With that evidence, the project can serve not only as a local safety intervention but also as a replicable model for rapid black-spot treatment in Uttar Pradesh.

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