

Equitable Transport Resilience to Urban Flooding in Chennai

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INTRODUCTION & AIM



Urban flooding disproportionately impacts transport access for vulnerable groups like low-income households, women, the elderly, and persons with disabilities. Conventional resilience planning prioritises infrastructure robustness but neglects equity outcomes.

AIM: Develop and apply the Equity–Resilience Integration Index (ERII), integrating the 4R resilience model with 3J justice framework for ward-level assessment of inclusive transport resilience.

$$ERII = RI \text{ (Resilience Index)} + JI \text{ (Justice Index)} \rightarrow \text{ERF Classification}$$

ERII FORMULA CONSTRUCTION

The Equity–Resilience Integration Index combines normalized technical and social dimensions:

$$ERII = (Rb + Rd + Rp + Rs)/4 + (Jd + Jp + Jr)/3$$

Scaled to 0-1 range

METHOD

- Data Collection:** Primary surveys, GIS spatial data, ward-level flood records, institutional assessment across Zone XIV
- Indicator Computation:** 7 indicators scored (Rb, Rd, Rp, Rs; Jd, Jp, Jr) at ward level using mixed methods
- ERII Calculation:** Composite RI + JI scores per ward; ERF typology classification (Critical / Moderate / Good)
- Mismatch Analysis:** Cross-indicator gap detection — resilience–justice blind spots by ward
- Intervention Design:** Ward-wise planning matrix + tiered recommendations from ERF classification

CONCLUSION

Spatially Explicit

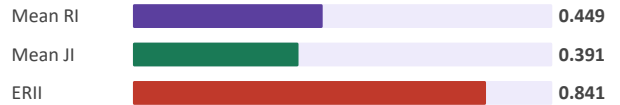
Ward-level GIS precision identifies vulnerability clusters and enables targeted interventions

Multi-Scalar

Applicable at ward, zone, and city level; scalable to Mumbai, Kochi, Ho Chi Minh City

RESULTS & DISCUSSION

Indicator	Ab br.	Score	Status
Robustness	Rb	0.434	Critical
Redundancy	Rd	0.396	Critical
Rapidity	Rp	0.318	Critical
Resourcefulness	Rs	0.650	Good
Distributional Justice	Jd	0.318	Critical
Procedural Justice	Jp	0.450	Moderate
Recognition Justice	Jr	0.406	Critical



Critical: Ward 189 (Perungudi) - ERII 0.3125 | Highest flood vulnerability | Pallikaranai Marsh adjacency | Lowest Rapidity in zone

EQUITY–RESILIENCE MISMATCH PROFILES



Infrastructure–Equity Gap · Wards 181, 188

High Rb + Low Jd: Roads exist but service distribution excludes EWS/LIG households



Network–Social Gap · Ward 188

High Rd + Low Jr: Multiple routes but elderly, PWD, women are excluded from safe use



Governance Gap · Most Wards

High Rs + Low Jp: Strong institutions but top-down decisions; no community voice in planning



Recovery Gap · Wards 189, 190

Low Rp + High Flood: Slowest recovery in most flood-exposed wards - emergency failure



Accessibility Gap · Wards 182, 191

Low Rd + Low Jd: Peripheral wards lack physical access AND equitable service delivery

TIERED INTERVENTION STRATEGY

IMMEDIATE 0–2 yrs	Elevated emergency corridors Ward 189; flood-safe MRTS feeder links; community real-time alert systems
MEDIUM-TERM 2–5 yrs	Ward Transport Committees; IPT formal integration; EV depot flood-proofing; gender safety audits
LONG-TERM 5+ yrs	Pallikaranai Marsh buffer enforcement; network expansion to peripheral wards 182, 191; city-wide ERII adoption

FUTURE WORK / REFERENCES

- Real-time flood-transport alert system integration
- Dynamic simulation and predictive mobility modelling
- Gender-disaggregated ERII sub-scores
- Participatory Ward Transport Committees
- Elevated corridors & emergency boat routes (Ward 189)
- City-wide ERF rollout across all Chennai zones