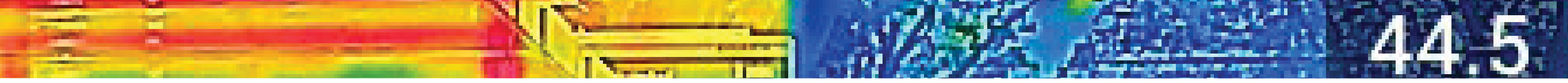
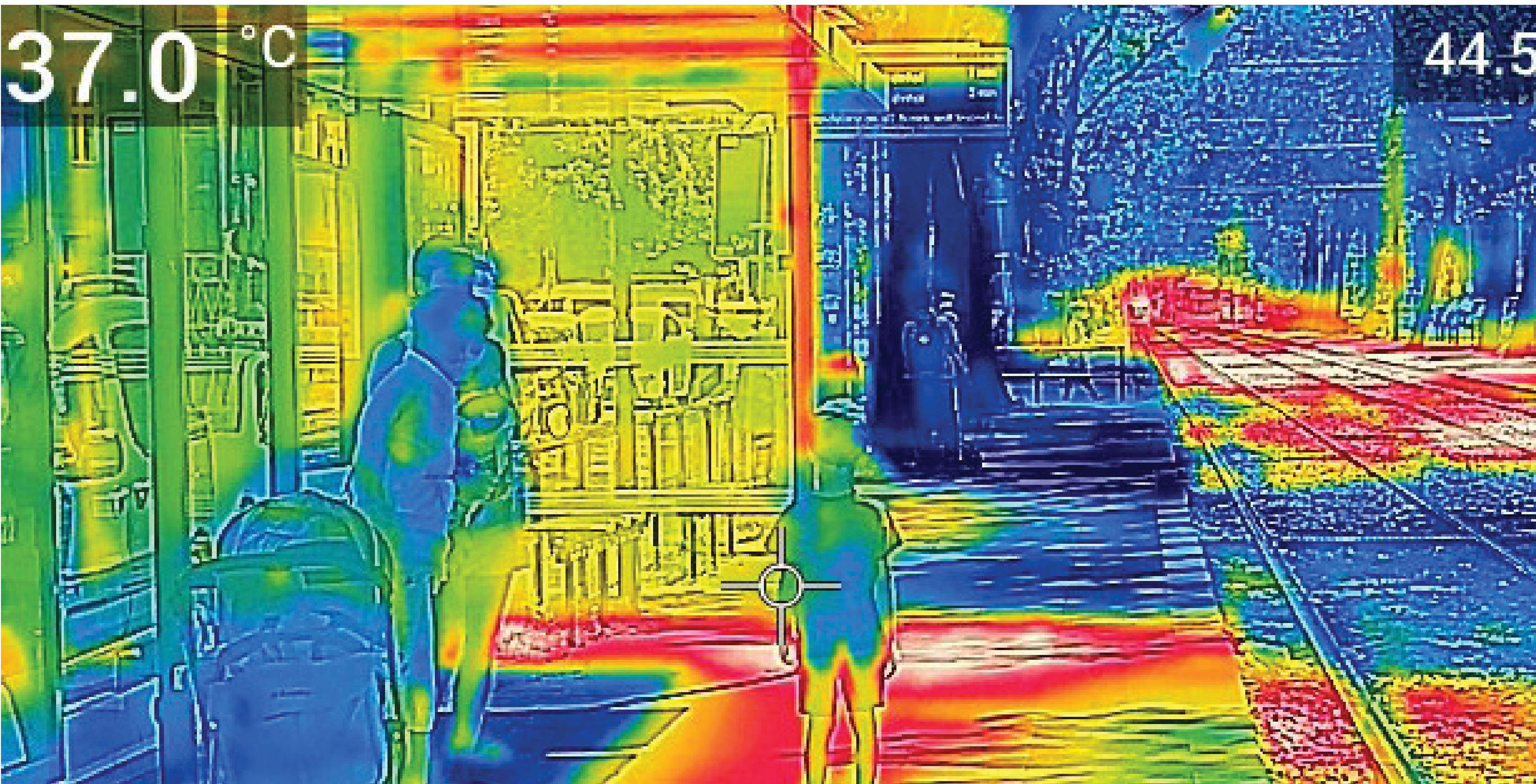


CDRI
Coalition for Disaster Resilient Infrastructure

Community of Practice for Extreme Heat Management in Public Transport Systems

Policymakers' Summary



January 2025

Policymakers' Summary

This CDRI guidance document addresses the growing impact of extreme heat on public transport systems. It outlines challenges, key frameworks, practical recommendations, and real-world examples, providing a roadmap for developing heat-resilient infrastructure.

The guidance combines concise insights to support decision-making and promote sustainable, climate-adaptive public transport systems.

1 Context Setting

Health & Safety
Environment
Economy

- **Rising temperatures pose a threat** to infrastructure, health, environment, and economy.
- **Public transport is important** for equitable economic growth and social inclusion.

2 Framework for Extreme Heat in Public Transport Systems

2.1 Research: Establishing Baselines

- **Knowledge mapping:**
  Identify gaps by engaging stakeholders and reviewing policies.
- **Support from resource institutions:**
  Partner with climate funds and research institutions.
- **Urban indicators and baselines:**
  Quantitative: Analyze heat maps, energy use, and environmental data.
  Qualitative: Use surveys and interviews to capture user vulnerabilities.

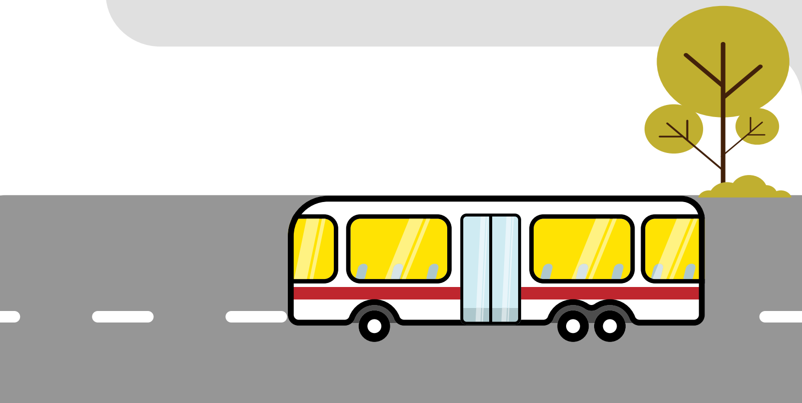
4 Guidance for Adapting Public Transport Systems to Extreme Heat

4.1 Long-Term Vision

Establish funding for heat resilient urban planning.

4.2 Heat Impact Screenings

Mandate health-centered projects to protect vulnerable populations.



2.2 Science Communication: Data Models

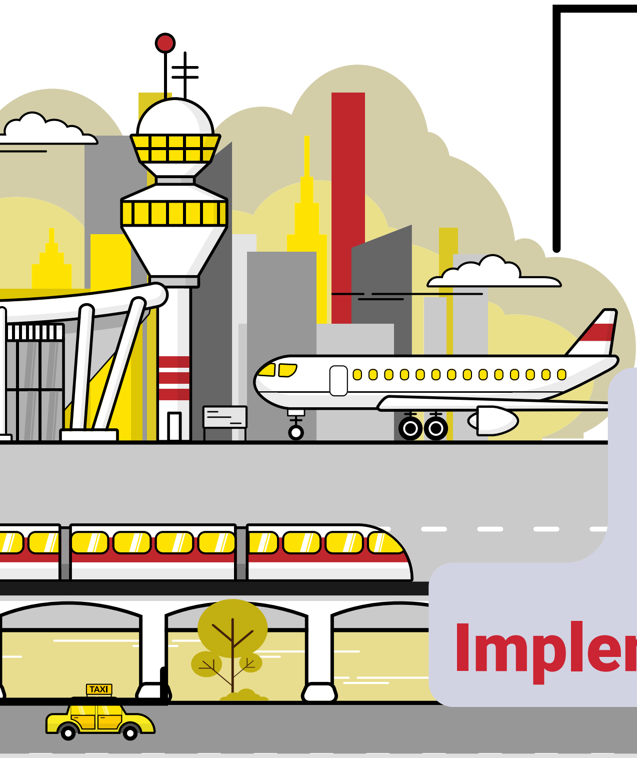
- **Quantitative visualizations:** Highlight heat stress areas with heat maps and metrics.
- **Qualitative visualizations:** Use storytelling to show user impacts across journey phases.

2.3 Stakeholder Planning: Multiple Goal Alignment

- **Align goals collaboratively:** For health, climate, and the economy.
- **Use scenario analysis:** To assess intervention feasibility

2.4 Integrated Design: Solutions and Performance

- **Nature-based design:** Use green infrastructure like shade and vegetation.
- **Risk-informed design:** Incorporate climate projections.
- **Performance-based design:** Assess thermal comfort, resilience, and co-benefits.



3 Actions for Implementation

3.1 Connecting Phase

- **Improve shaded walkways** and provide hydration points along transit paths.
- **Ensure accessible routes** for vulnerable populations.

3.2 Waiting Phase

- **Enhance transit stops** with shaded seating, cooling systems, and real-time information displays.

3.3 Riding Phase

- **Retrofit vehicles** with efficient cooling systems.
- **Minimize overcrowding** to reduce heat exposure inside transit vehicles.

4.3 Heat-Resilient Materials

Integrate passive cooling in infrastructure construction and renovation.

4.4 Clean Energy Fleets

Transition to low emissions through clean energy and more efficient systems.

4.5 Stops and Stations Climatization

Incentivize shading and cooling at all transit public spaces.

4.6 Data-Driven Decision Making

Enable predictive maintenance to protect infrastructure and staff.

4.7 Transport Frequency

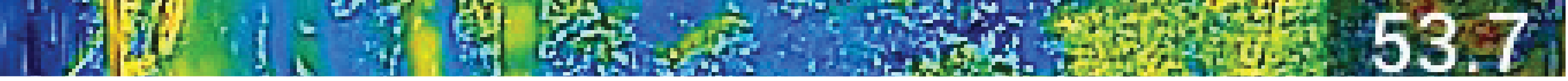
Shorten waiting times to reduce crowding and heat exposure.

4.8 Communications Systems

improve warnings and updates on heat waves and service delivery.

Recommendation	Action	Primary Goal
Establish a Long-Term Vision with Dedicated Funding for Heat Resilient Urban Planning	Develop and fund strategies for heat-resilient urban planning, including Transport Oriented Development (TOD) to minimize distances to transport hubs and cluster essential services around hubs. Ensure shaded and ventilated pathways along high-traffic routes for vehicles, pedestrians, and cyclists.	Reduce heat exposure for users and operators in first- and last-mile transport connections, supporting safe and accessible urban mobility.
Mandate Heat Impact Screenings for Transport Projects with a Focus on Vulnerable Populations	Require climate resilience assessments in transport project planning, with a focus on design adaptations that reduce extreme heat impacts for vulnerable users.	All new and upgraded transport infrastructure proactively addresses heat risks for the system and user populations, especially those of vulnerable users.
Integrate Heat-Resilient Materials in Transport Infrastructure Construction and Renovations	Incorporate heat-resistant and reflective materials in transport infrastructure (e.g., rails, roads, stops, station roofs) to reduce heat absorption.	Mitigate heat-induced wear on infrastructure to extend lifespan and reduce maintenance demands, as well as reduce ambient heat exposure for users and operators.
Transition Public Transport Fleets to Clean Energy with Efficient Cooling Systems	Upgrade public transport vehicles to clean energy sources (e.g., hybrid, electric) and install energy-efficient air conditioning and ventilation systems for both riders and the system's electrical components.	Ensure continued service of sustainable, comfortable public transport during extreme heat events.
Incentivize or Mandate Shading and Cooling at Transport Stops	Develop and upgrade transport stops and stations with shading structures and cooling features, such as ventilation and misting fans, with an emphasis on nature-based infrastructure and passive cooling measures. Develop and upgrade stops and stations with seating for riders and operators.	Ensure stops and stations are comfortable and safe, especially for vulnerable users, reducing the risk of heat-related incidents.
Enable Data Driven Decision Making and Predictive Maintenance for Transport Systems	Leverage real-time data and predictive analytics to optimize operational adjustments, adjust transport worker shift schedules during heatwaves, regulate ventilation, and schedule retrofitting and preventive maintenance.	Increase the safety and efficiency of transport operations during extreme heat events.
Improve Transport Frequency to Reduce Wait Times and Crowding	Increase the number of transport vehicles and use data-driven models to optimise fleet usage based on demand and weather patterns.	Minimise wait times and reduce crowding at stops and on transport.
Enhance the Communication and Timing of Heat Warnings and Service Updates	Issue detailed, actionable alerts across messaging platforms to help users manage extreme heat risks. Use AI-driven predictive analytics to proactively send warnings based on temperature forecasts, transport conditions, and projected demand patterns, with alerts timed well before peak commute hours.	Improve rider safety by providing timely heat warnings and updates that support protective actions and help manage crowding and transport flow during extreme heat events.

Co-benefits			Avenues of Action
Reduces heat stress for pedestrians and cyclists, promoting active health.	Lowers urban heat and private vehicle use.	Boosts foot traffic, benefiting businesses and property values.	• **Policymakers:** Set TOD targets, shading goals, and align land use with transport. • **Researchers:** Develop cost-effective shading and ventilation for local climates. • **Financiers:** Fund shading in TOD projects and offer incentives. • **Communities:** Advocate for shaded, ventilated pathways. • **Designers:** Plan accessible, shaded, ventilated transport routes with engineers. • **Operators:** Maintain and monitor shading infrastructure.
Reduces heat exposure and improves comfort for vulnerable users.	Promotes sustainable planning and nature-based solutions.	Minimizes heat disruptions, lowers repair costs, and boosts property values.	• **Policymakers:** Mandate heat-resilient designs for vulnerable populations. • **Researchers:** Develop heat maps and tools for vulnerable transit users. • **Financiers:** Fund adaptive infrastructure and green projects. • **Communities:** Advocate for heat-resilient infrastructure. • **Designers:** Address heat resilience and community needs in designs.
Lowers temperatures, reduces delays, and enhances comfort and safety.	Lowers heat and extends infrastructure lifespan, reducing carbon demand.	Cuts repair costs and boosts infrastructure durability.	• **Policymakers:** Mandate heat-resistant materials and fund high-heat area upgrades. • **Researchers:** Test materials for durability and cost-effectiveness in local climates. • **Financiers:** Fund heat-resistant designs and retrofits via incentives and partnerships. • **Communities:** Advocate for cooler, safer infrastructure. • **Designers:** Collaborate on heat-reflective infrastructure with engineers and scientists. • **Operators:** Inspect and maintain materials for long-term effectiveness.
Reduces heat stress, emissions, and respiratory risks.	Lowers carbon footprint, cooling demand, and noise pollution.	Saves fuel costs, offsets initial expenses, and boosts ridership by reducing stigma.	• **Policymakers:** Create incentives and targets for energy-efficient public transport. • **Researchers:** Develop cost-effective clean energy and cooling solutions. • **Financiers:** Fund and incentivize clean fleet transitions. • **Communities:** Advocate for eco-friendly public transport. • **Designers:** Plan infrastructure for clean energy, like charging stations. • **Operators:** Maintain cooling systems and train staff effectively.
Improves comfort and reduces heat stress, especially for vulnerable groups.	Combines shading with nature-based solutions to boost biodiversity and absorb rainwater.	Enhances ridership and foot traffic, increasing revenue and business activity.	• **Policymakers:** Require cooling and shading in transport designs for heat-prone areas. • **Researchers:** Develop passive, cost-effective cooling and shading solutions. • **Financiers:** Fund shaded infrastructure construction and upkeep in vulnerable areas. • **Communities:** Advocate for community-focused design and placement. • **Designers:** Create transport stops with integrated shading and seating. • **Operators:** Maintain cooling systems and evaluate effectiveness using real-time data.
Lowers infrastructure failure risks and enhances station ventilation.	Optimizes operations to cut energy use and carbon demand from replacements.	Maintains revenue, reduces repair costs, and boosts reliability.	• **Policymakers:** Mandate or incentivize data-driven transport systems. • **Researchers:** Develop predictive systems to monitor and forecast failures. • **Financiers:** Fund predictive maintenance technologies. • **Communities:** Advocate for data-driven transport management. • **Designers:** Integrate sensors and IoT technologies into transport networks. • **Operators:** Use real-time data to manage overcrowding and infrastructure stress.
Minimizes exposure and crowding, reducing heat-related health issues.	Promotes public transport use, cutting emissions and urban heat.	Increases ridership, revenue, and financial sustainability.	• **Policymakers:** Support fleet expansion and service frequency policies. • **Researchers:** Create demand- and weather-based scheduling systems. • **Financiers:** Fund fleet expansion and higher service frequency costs. • **Communities:** Advocate for less crowding and provide input on route planning. • **Designers:** Integrate real-time analytics into transport scheduling. • **Operators:** Adjust service frequencies based on real-time occupancy data.
Limits heat exposure and crowding, protecting vulnerable groups.	Lowers energy demand by reducing crowding and cooling reliance.	Improves punctuality, minimizing delays and lost work hours.	• **Policymakers:** Mandate early heat warnings and fund alert system maintenance. • **Researchers:** Develop AI-driven personalized heat alert systems. • **Financiers:** Fund the integration of alert systems in transport networks. • **Communities:** Collaborate to ensure clear and accessible messaging. • **Designers:** Create user-friendly alerts across apps, SMS, and public displays.



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CLIMATE RESILIENCE for ALL

Building Health Lab