

Resilience Hubs: Preparing Edmonton for Extreme Events and Climate Change

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WHAT ARE RESILIENCE HUBS?

Resilience hubs are facilities located within communities designed to improve residents' quality of life and increase the community's ability to respond to emergencies and disasters (Baja, 2016, 2018, 2019; Ciriaco & Wong, 2022). These hubs provide essential services and resources that are available both in everyday situations and during times of crisis. Each hub's specific elements and infrastructure are tailored to meet the unique characteristics and needs of the community it serves. Some of the key focuses of resilience hubs include mitigating the effects of climate change, improving social cohesion, promoting equity, and enhancing accessibility and mobility (Baja, 2018, 2019; Ciriaco & Wong, 2022; Kirwan et al., 2021). **As Edmonton continues to face increasing risks, resilience hubs can be used as an adaptation strategy for a changing climate and changing communities to promote preparedness and quality of life.**



Source: Drawing courtesy of Carolyn Carlberg

METHODOLOGY

The mixed-method approach involved a broad literature review, a survey of residents in Edmonton, Alberta (n=950), and focus groups with underserved populations (n=52). Data were used to uncover descriptive statistics, model factors that would influence behaviour related to hubs, and identify equity-centred considerations to address vulnerability. This methodology addresses the importance of needs-centred research for resilience hub design and placement.

KEY RESEARCH FINDINGS*

Hub Design and Resources

Finding 1: Over half of the surveyed residents believed that: 1) resilience hubs would help their community be more resilient, 2) hubs would meet the daily needs of their neighbours, and 3) hubs would increase social cohesion in their communities.

Finding 2: Respondents were highly supportive of services and resources for disaster events, including temporary shelter, backup power, and an information desk (see Table 1).

Finding 3: Residents stressed the importance of a range of basic amenities and resources that should be provided by hubs (Table 1), including food and water, restrooms and showers, heating/cooling, basic and urgent health services, and Wi-Fi.

Finding 4: Over 50% of respondents indicated that the following transportation elements were very or mostly important: 1) accessibility for individuals with disabilities; 2) car parking; 3) transit connections; 4) a location within walking distance from their residence (Table 1).

Hub Location and Placement

Finding 5: Pre-existing buildings that already serve residents, including community/recreation centres, libraries, and community leagues, were highly preferred by respondents and by focus group participants.

Finding 6: Respondents and focus group participants preferred a local hub location close to their residence (median of 1.7 km), especially those who would walk to a hub (median of 0.6 km).

Finding 7: Hubs were preferred in places with high levels of connectivity to the transportation network, including along major evacuation routes and near high pedestrian areas.

Hub Usage

Finding 8: Respondents were very/somewhat likely to use a hub under multiple disaster conditions including as a place to find disaster information (70%), gather resources (64%), seek temporary shelter (61%), and volunteer (60%) (see Figure 1).

Finding 9: A little under half of respondents (41%) would be very/somewhat likely to use a hub during normal conditions.

* Findings are based off publications in the "Open-Access Resources from this Research" section, which were authored by the research team.

Finding 10: Variables related to people’s perception of social cohesion and levels of social capital were associated with an increased likelihood of using a resilience hub under multiple conditions.

Finding 11: Underserved groups were often more likely to use hubs in normal and disaster conditions, though the specific group differed based on the situation.

Hub Transportation

Finding 12: Personal vehicles would be used by most individuals to reach a resilience hub during normal conditions (71%) and during an emergency (79%).

Finding 13: Walking and public transit were the next two most popular modes among respondents for normal conditions (15%, 8%) and disasters (9%, 4%), though they were most often preferred by underserved populations in the focus groups.

Finding 14: Underserved focus group participants emphasized the need for highly accessible hubs that could be integrated into the existing transportation network, especially since public transit would be regularly used.

Finding 15: Frequent public transit services and high-quality infrastructure for multi-modal transportation choices would help resilience hubs produce co-benefits, such as by serving as a mobility hub and connecting people to everyday services and resources.

BENEFIT-COST DISCUSSION

Our needs-based assessment of Edmonton residents indicates that existing, well-known, and highly-resourced buildings are preferred locations for resilience hubs. This suggests that the overall benefit-cost ratio will be relatively high. One important constraint will be the number of hubs that can be retrofitted and resourced. Officials will need to identify the trade-off between larger but fewer hubs or smaller but more hubs. A hybrid approach is recommended for Edmonton and other mid-size Canadian cities, where community league buildings can act as smaller centres and recreation centres can act as larger centres. It is also recommended that all new major, public buildings in Edmonton contain the necessary features to function 24/7 as a resilience hub for improved climate adaptation.

Funding will be needed for both capital and operational costs, though many buildings may already have these resources and elements. Additional funds may need to be set aside for staffing and resources in an emergency.

Initial infrastructure/capital costs might include:

- Solar or back-up power installation;
- Heating, cooling, and filtration systems;
- Accessible feature installation;
- Transportation improvements to sidewalks, crossings, bus stops, and bike facilities;
- Climate-resilient landscaping;
- Functional space re-design.

Operational costs might include:

- Emergency preparedness programming;
- Workforce and job training;
- Selective health services;
- Events to distribute resources to the community;
- Increased public transit frequency;
- Climate readiness education;
- Community league activities.

OTHER IMPLEMENTATION CONSIDERATIONS

To aid the implementation of resilience hubs, a placement criteria matrix has been designed (Appendix A) based on the research. The matrix scores possible locations, which will help officials prioritise hub locations throughout the city. Officials should also consider the following:

- Resilience hubs must have enough space to accommodate the community's needs during both normal conditions and emergencies and surge as necessary to operate year-round.
- Resilience hubs should be well-known and trusted by the community, though schools may miss the daily services that are needed by community members.
- Resilience hubs should not be considered a substitute for larger evacuation shelters, but rather play a complementary role in disaster preparedness and response.
- Resilience hub operations should identify the source, speed, and usefulness of disaster resources.
- For Edmonton and other Canadian cities, hub design and infrastructure should first focus on extreme heat, extreme cold, wildfire smoke events, and power outages to ensure a range of viability.



Source: Urban Sustainability Directors Network (USDN)

Table 1 – Services and resources to be provided by resilience hubs – resident preferences (Ciriaco et al., 2024)

Services and resources to be provided by resilience hubs		
Services and resources related to emergencies/ disasters that are considered very and mostly important to be provided by resilience hubs	Shelter (temporary in disaster)	76.4%
	Back-up/emergency power	74.1%
	Support for reuniting families	68.9%
	Information desk	67.6%
	Community emergency response training	61.7%
Basic services and resources are considered very and mostly important to be provided by resilience hubs	Water	83.3%
	Restrooms	81.5%
	Warming centre	81.1%
	Food bank	78.2%
	Urgent care	74.6%
	Market/grocery	69.8%
	Showers	69.6%
	Cooling centre	64.7%
	Basic health services	62.0%
Wi-Fi	58.3%	
Services and resources related to transportation that are considered very and mostly important to be provided by resilience hubs	Accessible for individuals with disabilities	68.4%
	Car parking	57.3%
	Transit connection	56.7%
	Resilience hub be within walking distance from the residence	52.1%
	Heated bus stop	42.6%
	Parking for electric vehicles	38.3%
	Bike sharing	31.6%
Bike parking	31.2%	

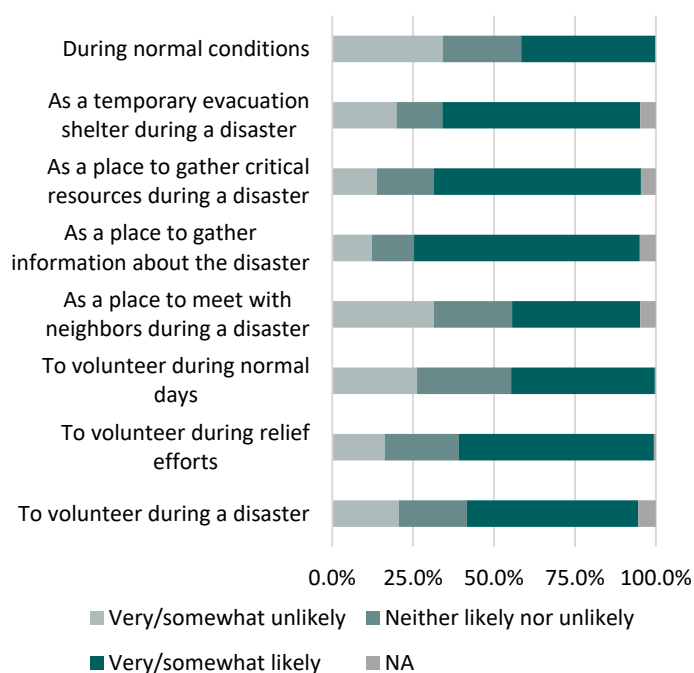


Figure 1 - Likelihood of resilience hub usage (Ciriaco et al., 2024)

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APPENDIX A – RESILIENCE HUB PLACEMENT TOOL

This tool can be used to score, prioritize, and select resilience hub locations throughout an urban environment. Criteria are based on the research, and the entire matrix with associated descriptions and research evidence can be found in Ciriaco et al. (2024).

Transportation/ Placement Criteria	Suggested Weights	5	4	3	2	1	0	Min
Distance from residence and centrality	10%	The resilience hub is within a 3 km radius of all target community's residences		The resilience hub is within a 5 km radius of all target community's residences		The resilience hub is farther than a 7 km radius of all target community's residences	NA	1
	2.5%	The resilience hub is located adjacent to the highest density of residences in the target community		The resilience hub is located adjacent to a medium density of residences in the target community		The resilience hub is located adjacent to a very low density of residences in the target community	NA	1
	5%	The facility to be retrofitted is already centrally located within the neighbourhood		The facility to be retrofitted is within the boundaries of the neighbourhood		The facility to be retrofitted is beyond the boundaries of the neighbourhood	NA	1
Public Transit Connections	2.5%	There is at least one public transit stop (bus stop or train station) next to the resilience hub or within 0.2km of the resilience hub		There is at least one public transit stop (bus stop or train station) within 0.5km of the resilience hub		There is at least one public transit stop (bus stop or train station) within 1km of the resilience hub	No stops exist within 1 km	1
	2.5%	The location selected has a high frequency (15 min or less) of bus/train services during AM and PM peak hours on weekdays		The location selected has medium frequency (30 to 40 min) of bus/train services during AM and PM peak hours on weekdays		The location selected has low frequency (60 min or more) of bus/train services during AM and PM peak hours on weekdays	The location has no bus/train services	1
	1.25%	The location selected has a high frequency (30 min or less) of bus/train services during midday off-peak hours on weekdays		The location selected has a medium frequency (40 to 50 min) of bus/train services during midday off-peak hours on weekdays		The location selected has a low frequency (60 min or more) of bus/train services during midday off-peak hours on weekdays	The location has no bus/train services	1
	1.25%	The location selected has a high frequency (30 min or less) of bus/train services during evening off-peak hours on weekdays		The location selected has a medium frequency (50 to 60 min) of bus/train services during evening off-peak hours on weekdays		The location selected has a low frequency (60 min or more) of bus/train services during evening off-peak hours on weekdays	The location has no bus/train services	1
	2.5%	The location is served by at least 5 public transit routes within 0.5 km		The location is served by at least 3 public transit routes within 0.5 km		The location is served by 1 public transit route within 0.5 km	The location is served by 0 public transit routes.	1
	Note: Frequency of transit service connections may differ in sub-urban neighbourhoods depending on factors such as demand and population density. Fixed or on-demand transit counts for this category.							
Active transportation infrastructure	2.5%	Pedestrian sidewalks are available to connect active transportation users to resilience hubs		Sidewalks are available but may be fragmented		Sidewalks are available but they are in poor condition	No sidewalks are available	3
	2.5%	The location has crosswalks within or at the end of the block that are safe, well-structured, and signed/signalized		The location has crosswalks nearby that are somewhat safe, well-structured, and/or signed/signalized		The location has minimal crosswalks nearby or are unsafe, poorly structured, or unsigned/unsignalized	No crosswalks are available	3
	5%	Pedestrian sidewalks and crosswalks connected to resilience		Pedestrian sidewalks and crosswalks are only partially accessible for people		Pedestrian sidewalks and crosswalks are not accessible for	No crosswalks are available	3

		hubs are accessible for people with disabilities and/or people with limited mobility (e.g., sufficient sidewalk spaces for those who use wheelchairs, walkers, motorized devices)	with disabilities and/or people with limited mobility but could be redesigned to meet their needs	people with disabilities and/or people with limited mobility		
	1.25	The location has bike infrastructure (e.g., bike lanes, cycle tracks, shared pathways) within the block to connect active transportation users to resilience hubs	The location has bike infrastructure (e.g., bike lanes, cycle tracks, shared pathways) to connect active transportation users to resilience hubs, but they are fragmented	The location has minimal bike infrastructure (e.g., bike lanes, cycle tracks, shared pathways) to connect active transportation users to resilience hubs	No bike infrastructure is available	1
	1.25%	The location has sufficient and well-maintained bike parking and bike storage infrastructure	Bike parking and storage infrastructure is available but not well maintained and/or not sufficient for resilience hub users	Bike parking and storage infrastructure is available but not well maintained and/or not sufficient for resilience hub users	No bike parking and storage are available	1
Type of places to be retrofitted into resilience hubs	10%	The location has the infrastructure and operational capacity that allows for services to run 24/7 during normal days and during emergencies	The location has the infrastructure or operational capacity that can serve the community during normal conditions and give partial support (e.g., business days only) during emergencies, or it has infrastructure that can serve the community during emergencies and give partial support during normal days	The location can serve the community only for a few business days during emergencies or during regular days	The location cannot serve the community during any regular hours	3
	5%	The location is accessible for people with disabilities and older adults, and meets all the guidelines set by the City of Edmonton's Access Design Guide	The location does not meet all of the guidelines set by the Access Design Guide but can be restructured to accommodate accessibility needs	The location is minimally accessible and cannot be retrofitted to add accessibility features	No accessibility features are available	3
	5%	The location is well-known and already well-utilized by the community	The location is known but not well-utilized	The location is neither well-known nor utilized by the surrounding community	NA	1
	2.5%	The location already has existing substantial on-street and off-street parking space	The location has some on-street and off-street parking space	The location has limited on-street and off-street parking space	No on-street or off-street parking	1
Interconnectivity between resilience hubs	1.25%	The selected location has a good transportation network that connects it to other potential resilience hub locations	The selected place has an adequate transportation network that connects it to other potential resilience hub locations	The selected place has a poor transportation network and fails to connect to other potential resilience hub locations	NA	1
Vulnerability of hub location	1.25%	The selected hub location is near the hazardous area	The selected hub location is located close to the hazardous area	The selected hub location is located immediately adjacent to the hazard	NA	3
Community vulnerability to hazards	2.5%	The community selected is highly impacted by one or more kinds of hazards (e.g., wildfires, heatwaves, smoke events, blizzards, extreme cold, tornadoes)	The community is moderately impacted by one or more hazards (e.g., wildfires, heatwaves, smoke events, blizzards, extreme cold, tornadoes)	The community is minimally impacted by one or more hazards (e.g., wildfires, heatwaves, smoke events, blizzards, extreme cold, tornadoes)	There are no hazards that impact the community	1

Services/Resources Criteria	Suggested Weights	5	4	3	2	1	0	Min
Basic services/necessities	10%	Basic services such as food and water resources, restrooms, and first aid are sufficiently available to resilience hub users during normal conditions and emergency scenarios		Basic services such as food and water resources, showers, and restrooms, and first aid are somewhat limited or require improvement in quality		There is a shortage of basic services for resilience hub users, and/or services are of poor quality	There are no basic services	1
Services for underserved populations	2.5%	There are strong partnerships and collaborations with community-based organizations representing underserved populations during hub programming and design		Some partnerships exist with community-based organizations that represent underserved populations		Minimal partnerships exist with community-based organizations that represent underserved populations	No partnerships exist	3
	2.5%	Information services are available in multiple languages in order to accommodate resilience hub users with limited English proficiency*		Information services in other languages are somewhat available or partially accommodate the range of languages used by resilience hub users		Information services in other languages are limited or fail to accommodate the range of languages used by resilience hub users	Information services in other languages are unavailable	1
	2.5%	Underserved populations are sufficiently involved in the planning and design of resilience hubs (e.g., through workshops, information sessions, discussions with community leagues)		Underserved populations are somewhat involved in the planning and design of resilience hubs, but their participation is limited		Underserved populations are minimally involved in the planning and/or design of resilience hubs	Underserved populations are not involved	3
Community emergency preparedness and response training	2.5%	The resilience hub offers emergency preparedness and/or response training that is effective and tailored to the community's hazard risks		The resilience hub offers preparedness and/or emergency response training that is somewhat effective or partially tailored to the community's hazard risks		The resilience hub offers minimal preparedness and/or emergency response training/information	There is no training or information at hubs	1
Heating and/or cooling systems	2.5%	The resilience hub is equipped with heating and cooling systems for extreme weather events. The systems are regularly maintained		Available heating/cooling systems are only adequate or regularly experience malfunctions		Heating/cooling systems are either usually unavailable or unreliable for extreme weather events	No heating or cooling is available	3
Emergency Services	2.5%	The location has sufficient sheltering spaces for emergency scenarios		The location has partial sheltering spaces for emergency scenarios		The location has limited sheltering spaces for emergency scenarios	Sheltering space is unavailable	3
	2.5%	On-site backup power is available for power outage events		On-site backup power for power outage events is available for some time		On-site backup power for power outage events is available for limited services	Backup power is unavailable	3
	2.5%	Family reunification support is available during emergency evacuations		Some family reunification support is available but not fully developed		Minimal family reunification support is available	No family-reunification support is available	1
	2.5%	Trained medical staff are available to offer medical and physical support to people seeking shelter		Staff are available but only partially meet the needs of the shelter population and/or lack high-quality training		Staff are available but are few in number compared to the shelter population and/or lack adequate training	No staff are available	3