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"Efficiency - Equity - Clarity"

Lessons From Katrina

What A Major Disaster Can Teach Transportation Planners

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Abstract

This paper examines failures in Hurricane Katrina disaster response and their lessons for transportation policy and planning in other communities. The evacuation plan functioned relatively well for motorists, but failed to serve people who depend on public transit. Effective disaster response must understand the abilities and needs of non-drivers, many of whom are economically, socially and physically disadvantaged. This paper identifies various policy and planning strategies that can help create a more efficient, equitable and resilient transport system.

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Introduction

A good planning principle is to “hope for the best but prepare for the worst.” We often have trouble imagining the worst scenario until the terrible event occurs. Only then do we discover our planning failures.

Calamities often occur in groups. The Katrina disaster began August 29 with a hurricane, which led to flooding, infrastructure damage, fires, civil disorder, toxic chemical dispersion, disease risk, and thousands of people isolated for days without water, food or medical care. Disaster response had to contend with all of these problems.



There is much to learn from this disaster. This paper examines one specific set of issues: lessons related to transport policy and planning. This analysis is not intended to fault individuals; rather it attempts to honestly examine the planning failures that contributed to this disaster. If we are to make any moral judgments and accuse individuals of being “bad,” it would be against anybody who hides, denies or understates the failures that occurred and so prevents society from learning to avoid such errors in the future.

Various long-term planning errors contributed to this disaster: the concentration of poverty in areas vulnerable to flooding, allowing shoreline development that eliminated protective barrier islands and wetlands, and underfunding levee maintenance (Bourne, 2004; Begley, 2005). There is also evidence that global warming exacerbated Katrina’s impacts by increasing ocean surface water temperatures. Federal security planning may have focused excessively on terrorist risks at the expense of more mundane but larger risks from natural disasters. These are all important issues to explore, and where appropriate, correct. However, this paper focuses only on transport policy and planning issues.

It is worth noting that this disaster could have been worse. Hurricanes follow a predictable path and provide considerable warning. The city has a well-established hurricane response plan and there was time to prepare. Road conditions were good during the evacuation period. The hurricane did not follow the most damaging possible course, and much infrastructure survived. Although delayed, extensive emergency response and relief was provided. Actual deaths were a fraction of the 50,000 predicted. Other disasters or other conditions could result in far more deadly and damaging events.

What Failed

It would be wrong to claim that this disaster was an unavoidable “act of god.” Katrina began as a hurricane but only became a disaster because of significant, preventable planning and management failures.

By most accounts, automobile evacuation functioned adequately. The plan, which involved using all lanes on major highways to accommodate outbound vehicle traffic, was well engineered and publicized (Wolshon, 2002). Motorists were able to flee the city in time, although congestion resulted in very slow traffic speeds and problems when vehicles ran out of fuel or had other mechanical problems.

However, there was no effective plan to evacuate residents who rely on public transportation. In an article titled “Planning for the Evacuation of New Orleans” published in the *Institute of Transportation Engineers Journal* (Wolshon, 2002, p. 45) the author explains,

Of the 1.4 million inhabitants in the high-threat areas, it is assumed only approximately 60 percent of the population or about 850,000 people will want, or be able, to leave the city. The reasons are numerous. Although the primary reasons are a lack of transportation (it is estimated that about 200,000 to 300,000 people do not have access to reliable personal transportation), an unwillingness to leave homes and property (estimated to be at least 100,000 people) and a lack of outbound roadway capacity.

This indicates that public officials were aware of and willing to accept significant risk to hundreds of thousands of residents unable to evacuate because they lacked transportation. The little effort that was made to assist non-drivers was careless and incompetent. According to accounts, public officials provided little guidance to people without personal vehicles, and when asked, they simply directed them to the Superdome (Renne, 2005), although it had insufficient water, food, medical care and security. This led to a medical and humanitarian crisis.

New Orleans officials were aware of the risks facing transit-dependent residents. These had been described in recent articles in *Scientific American* (Fischett, 2001) and *National Geographic* (Bourne, 2004) magazines, and from previous experience (see box on the next page). A July 2004 simulation of a Category 3 “Hurricane Pam” on the southern Louisiana coast by the Federal Emergency Management Agency (FEMA), projected 61,290 dead and 384,257 injured or sick in a catastrophic flood of New Orleans. City and regional emergency plans describe likely problems in detail (Louisiana, 2000; New Orleans, 2005). The *City of New Orleans Comprehensive Emergency Management Plan* (New Orleans, 2005) states:

The city of New Orleans will utilize all available resources to quickly and safely evacuate threatened areas. ...Special arrangements will be made to evacuate persons unable to transport themselves or who require specific life-saving assistance. Additional personnel will be recruited to assist in evacuation procedure as needed. ...Approximately 100,000 citizens of New Orleans do not have means of personal transportation.

The *Southeast Louisiana Hurricane Evacuation and Sheltering Plan* specifies that school and municipal buses should be used to evacuate people who lack access to private transportation (Louisiana, 2000, p. 13):

The primary means of hurricane evacuation will be personal vehicles. School and municipal buses, government-owned vehicles and vehicles provided by volunteer agencies may be used to provide transportation for individuals who lack transportation and require assistance in evacuating.

Some Can't Evacuate New Orleans for Ivan

Free Republic (www.freerepublic.com/focus/f-news/1477282/posts), by Mary Foster

NEW ORLEANS (23 Sept. 2004) - Fleeing to safety was not an option for some people as 140-mph Hurricane Ivan churned toward the Gulf Coast, threatening to submerge the below-sea-level city in what could be the most disastrous storm to hit in nearly 40 years.

Latonya Hill, who waited out the dangerous storm sitting on her stoop Tuesday, said the official pleas for residents to pack up and leave meant little to her. "Got no place to go and no way to get there," said the 57-year-old grandmother, who lives on a disability check and money she picks up cleaning houses or baby sitting. "They say evacuate, but they don't say how I'm supposed to do that," Hill said. "If I can't walk it or get there on the bus, I don't go. I don't got a car. My daughter don't either."

Hill is among the estimated 100,000 people in New Orleans who rely on city transportation to get around, making evacuation impossible for them. Yet, no shelters were open in the city as of Tuesday night and there were no plans to open any. The city was working on setting up a shelter of "last resort," Mayor Ray Nagin said. No shelters had been set up yet because of concerns about flooding and capacity, Nagin added.

At 5 a.m. Wednesday, Ivan was about 220 miles from the city and moving at 12 mph. Forecasters said Ivan could bring a coastal storm surge of 10 to 16 feet, topped by large, battering waves. More than 1.2 million people in metropolitan New Orleans were warned to get out as Ivan approached, and those who could streamed inland in bumper-to-bumper traffic in an agonizingly slow exodus, spurred by dire warnings that the hurricane could overwhelm New Orleans with up to 20 feet of water.

The New Orleans Regional Transit Authority (RTA) had a hurricane evacuation policy: Drivers were to load up buses and other agency vehicles with their families and transit-dependent residents and drive to nearby cities, thereby evacuating people and protecting vehicles. There are unconfirmed stories that Amtrak offered use of a train for evacuation that was not accepted by local officials. But neither public buses nor trains were deployed to evacuate people out of the city (Murdock, 2005). Residents who wanted to leave the area by public transport were expected to pay for commercial services, a major barrier to many low-income residents.

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New Orleans Mayor Ray Nagin later explained that, in his interpretation, using buses to transport residents to the Superdome reflected the emergency plans' intent, and there were insufficient buses to evacuate everybody who needed assistance. The city had approximately 500 transit and school buses, a quarter of the estimated 2,000 buses needed to evacuate all residents needing transport. However, if given priority in traffic buses could have made multiple trips out of the city during the 48-hour evacuation period, and even evacuating 10,000 to 30,000 people would have reduced emergency shelter overcrowding. Many public buses were subsequently ruined by the flooding (Preston, 2005).



Flooded New Orleans School Buses

Federal emergency officials also failed to deploy buses for evacuation as planned. A top FEMA staff described his surprise and frustration at the agency's inadequate preparation before Katrina struck, despite his urgent warnings to agency executives (Bosner, 2005). He says that at the time he wondered, "Where are the buses to get people out of there?"

The importance of buses for evacuation of the city became clear soon after the hurricane hit. On September 1 Mayor Nagin said on a local radio station, "I need 500 buses... This is a national disaster. Get every doggone Greyhound bus line in the country and get their asses moving to New Orleans." Two weeks after the hurricane he explained on NBC's *Meet the Press* (www.msnbc.msn.com/id/9240461):

"Sure, there was [sic] lots of buses out there, but guess what? You can't find drivers that would stay behind with a Category 5 hurricane, you know, pending down on New Orleans. We barely got enough drivers to move people on Sunday, or Saturday and Sunday, to move them to the Superdome. We barely had enough drivers for that. So sure, we had the assets, but the drivers just weren't available."

This indicates that bus deployment was ad hoc, implemented by officials during the emergency without a detailed action plan. Such a plan would include the designation of certain staff as *essential*, meaning that they are expected to work during emergency situations. Transit agency staff would have an incentive to volunteer for such a role because they would be allowed to evacuate their own families.

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It is not very surprising that public officials directed transit-dependent residents to local emergency shelters, since that strategy had worked successfully during previous hurricanes. This suggests that public officials were unaware of the greater severity of Katrina and were insensitive to the risks and discomfort facing shelter occupants. A more cautious and compassionate plan would have provided all residents the option of free evacuation transport out of the city.

This situation is simply an extreme example of the problems non-drivers face every day. In most North American cities, New Orleans included, public transit is considered a mode of last resort or a novelty for tourists and special events. Most middle-class residents seldom use public transit and so have little reason to support it. As a result, service quality is minimal, and poorly integrated into the overall transport system.

The result is a huge difference in convenience, comfort and safety between motorists and non-motorists (and therefore between wealthy and poor, white and black, able and disabled), which is degrading and inequitable (“Evaluating Transportation Equity,” VTPI, 2005). It is also inefficient and leads to additional problems, such as costly and dangerous rescue efforts, health problems, and distrust of authority.

After the hurricane there was no lack of material or human resources ready for deployment. Water, food, state-of-the-art equipment, and skilled rescuers were available and waiting, but were turned back, misdirected or misused (Murdock, 2005). Civil organizations were not allowed into the city to provide assistance. The American Red Cross explained soon after the hurricane struck (2005),

Access to New Orleans is controlled by the National Guard and local authorities and while we are in constant contact with them, we simply cannot enter New Orleans against their orders. The state Homeland Security Department had requested--and continues to request--that the American Red Cross not come back into New Orleans following the hurricane. Our presence would keep people from evacuating and encourage others to come into the city.

The official response, when it came, was slow and confused, leaving tens of thousands of people without food, water, medical treatment or public services. Within a few days civil disorder developed, with reports of looting and violence. According to Bradshaw and Slonsky (2005) public officials overreacted by focusing on protecting property rather than helping victims (for example, police chased thirsty and hungry people away from stores to prevent “looting,” even though this was the only source of drink and food available and much of it would soon spoil), and by preventing a non-violent group from obtaining help or leaving the city, due to their fear of being attacked (emergency medical technicians Larry Bradshaw and Lorrie Beth Slonsky claim they were threatened at gunpoint by sheriffs as they tried to obtain assistance for a group that was primarily African-American).

With better planning, hundreds of deaths could have been avoided and billions of dollars in property and productivity could have been preserved. Better planning could also have greatly reduced the fear, discomfort, frustration and violence experienced by residents.

Table 1 Examples of Poor Decision-Making

General	Transportation
<ul style="list-style-type: none"> • Failure to track the number of people at the Superdome and convention centers, and provide adequate facilities and resources. • Failure to define who is in charge, conflicts over authority, and inadequate communication among top-level decision-makers. • Failure to immediately distribute food and water after the hurricane. • Waiting until the fourth day to deploy the National Guard and military, or supply ships waiting nearby. • Failure to provide security to rescue and medical teams. • Failure to help evacuate families of essential city staff (police, fire, transit, healthcare, utility, etc.) so they could continue with and concentrate on emergency work. • Official overreaction to reports of violence, and so failing to provide help or allow evacuation of some people, particularly African-Americans. • Failure to show respect and compassion to disadvantaged people. 	<ul style="list-style-type: none"> • Failure to have an effective evacuation plan for non-drivers. • Failure to prioritize evacuation to insure that the most vulnerable (residents of the riskiest neighborhoods, and people with physical disabilities and special medical needs) are evacuated first. • Failure to understand and address the reasons that discourage many people from evacuating. • Failure to offer free or subsidized transportation out of the city to people who needed it. • Failure to use public transit, school buses, charter buses and trains for evacuation. • Failure to implement a transit and school bus “evacuation action plan” with an inventory of vehicles and operators. • Failure to give buses and other high occupancy and service vehicles priority in traffic. • Failure to coordinate vehicle rentals and fuel distribution. • Failure to accommodate pets.

Could We Do Better?

Other countries have more effective disaster response than the U.S. For example, by all accounts Cuba has an outstanding system to alert residents, organize evacuations, maintain public services during evacuation periods, and repair damages (Cohn, 2005; Martin, 2005). It accommodates special needs, such as medical services for evacuees.

Cuba is a socialist dictatorship. Its government and economic policies are not an attractive model. But Cuba has shown that financial or technical resources are not the key to effective emergency response. Rather than dismissing Cuba’s disaster preparation and response programs because the government is communist, it would be better to learn from them and do even better.

Overcoming Resistance to Evacuation

It is important to understand residents' reasons for refusing to evacuate when ordered before and after Katrina struck. Interviews and surveys of people who stayed in New Orleans indicate various reasons for their decision:

- Many lower income people lacked a vehicle and money.
- Many had no place to go and were fearful of conditions in emergency shelters.
- Many had survived previous hurricanes safely in their homes.
- Many did not expect the hurricane to be as bad as it was.
- Some wanted to protect their homes or pets.
- Some were proud of their ability to endure the risks and discomfort of the disaster.

A variety of strategies would probably be needed to increase evacuation rates, including more information on the risks facing people who stay, subsidized transportation, more comfortable and secure shelters, and better protection of homes.

Had residents been offered free transportation out of and back to the city, and assurance of a relatively comfortable and safe refuge, perhaps half of those who stayed would have left. This would have greatly reduced crowding at emergency shelters and subsequent rescue problems. Assuming 200,000 residents had accepted free evacuation transportation at a cost of \$100 each, it would have required \$20 million in subsidy. This may seem costly for a single city (it represents about 20% of the regional transit agency annual budget), but is tiny compared with the costs it would have avoided.

Pets present a particular challenge. Before a disaster strikes it seems unreasonable to abandon or destroy pets. It is therefore important to try to accommodate pets, by allowing animals to accompany evacuees (perhaps only small animals in a carrying cage) or by having special SPCA services to collect pets and house them in kennels.

Caring For The Most Vulnerable

An important test of a transportation system's effectiveness and fairness is its ability to accommodate the needs of the most vulnerable users under extreme conditions ("Basic Mobility," VTPI, 2005). Katrina disaster response failed in those terms. People who had resources were served relatively well because planners are familiar with their abilities and needs. People who were poor, disabled or ill were not well served, apparently because decision-makers were unfamiliar with and insensitive to their needs.

The City of New Orleans does provided a section on "Emergency Guide for Citizens with Disabilities" in its *Comprehensive Emergency Management Plan* posted on the City's website (New Orleans, 2005), but it contains little practical support, placing most of the responsibility for safety and evacuation on individuals. The Guide recommends that people with disabilities develop a "support system" to provide help during disasters. The "General Evacuation Guidelines" advises, "If you need a ride, try to go with a neighbor, friend, or relative," but provides no directions for people who lack neighbors, friends or relatives who have extra capacity in their evacuation vehicles, which is likely to be common in areas where poverty is concentrated.

Non-drivers include a diverse group of people who face various combinations of physical, economic and social disadvantages. A system designed for non-drivers must therefore be able to accommodate a wide range of needs, including poverty, physical and mental disabilities (Access Board, 2005), illnesses, inability to speak or read English, parents with young children, distrust of authority, frustration and anger. Many non-drivers lack convenient access to the Internet, and some lack regular telephone and mail service. Many had nowhere to stay outside of the city and no money to pay for housing, food or return transportation. Understanding and responding to these diverse needs is therefore important for effective disaster management and evacuation planning.

Planning For Resilience

A key concept recognized by engineers and planners is the value of *resilience* (“Evaluating Transportation Resilience,” VTPI, 2005), which refers to a system’s ability to accommodate variable and unexpected conditions without catastrophic failure, or “the capacity to absorb shocks gracefully” (Foster, 1993).

Resilience acknowledges *uncertainty*, our inability to know what combination of conditions will occur in the future. If the future were predictable, resilience would lose its importance: individuals and communities would simply need to plan for a single set of conditions. But since the future is unpredictable, it is necessary to plan for a wide range of possible conditions, including some that may be unlikely but which could result in significant harm if they are not anticipated.

Resilience tends to increase if a system has diversity, redundancy, efficiency, autonomy and strength in its critical components. This allows the system to continue functioning if a link is broken, if a particular resource becomes scarce, if a particular decision-maker is unavailable, etc. Resilience is affected by a system’s ability to collect and distribute critical information under extreme conditions. Resilience tends to increase if a system has effective ways to prioritize resources. For example, evacuations could be more efficient if buses and trains were given priority over lower-occupancy vehicles, were needed to avoid congestion and bottlenecks, or to use limited fuel resources most efficiently.

A single highway lane can typically accommodate a maximum of about 2,000 vehicles per hour, but less under mass evacuation conditions because of congestion, diverse and overloaded vehicles (many tow heavily loaded trailers), weather (rain and flooding), infrastructure failures (such as earthquake damage), and vehicle mechanical problems, crashes and driver confusion. Assuming that each highway lane accommodates 1,000 vehicles per hour under such conditions and vehicles carry an average of 2.5 passengers, each lane accommodates 2,500 passengers per hour. A four-lane highway can therefore evacuate about 10,000 people per hour, or 20,000 if inbound lanes are reversed. A city with one million residents and two four-lane highways in functional conditions would therefore require about 50 hours to evacuate all residents by automobile.

Assuming that a highway lane can accommodate 600 buses per hour (according to the *Highway Capacity Manual* a bus or truck represents 1.5 Passenger Car Equivalents on level highway conditions, and 2.5 under rolling conditions) and buses carry an average of 25 passengers, each bus lane accommodates 15,000 passengers per hour, the same as six lanes of automobile traffic. Highway capacity can therefore more than double by dedicating one lane to buses and encouraging residents to use buses and other high occupant vehicles such as vans with more than six passengers (“HOV Priority,” VTPI, 2005). A city with one million residents and two four-lane highways in functional conditions would therefore require only about 24 hours to evacuate all residents if about half are transported by bus and other high occupancy vehicles. In some situations trains may also be useful for mass evacuations. Urban light rail lines can carry 20,000 passengers per hour, and heavy rail lines even with good management.

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Resilience is also important for addressing long-term changes, such as traffic problems resulting from roadway damage (Giuliano and Golog, 1998), and increasing fuel prices. For example, the financial burden faced by consumers from increased fuel prices is reduced if their community has good travel alternatives (walking and cycling conditions, rideshare and public transit services, telecommuting and delivery services that substitute for physical travel), and so have the ability to reduce their vehicle use with minimal problem. This flexibility benefits not only people who shift mode and reduce their automobile travel, but also those who continue driving, due to reduced congestion and greater price elasticities, so fuel price rises will tend to be smaller.

Below are examples of specific ways to increase transportation system resilience (“Evaluating Transportation Resilience,” VTPI, 2005).

- Include disaster response as part of all transportation planning (local, regional, national, transit, etc.). Consider the widest possible range of possible disasters and stresses on the transport system, and consider the widest possible range of possible solutions.
- Develop an emergency action plan that identifies who will do what during disasters. Update the plan regularly, particularly after a disaster event tests its effectiveness.
- Value diversity, flexibility and redundancy (“Evaluating Transport Diversity,” VTPI, 2005). Develop a multi-modal transportation system that provides a variety of mobility options.
- Design transportation facilities to withstand extreme conditions (earthquakes, storms, etc.).
- Create transportation system networks that provide multiple links to each destination, including multiple rail lines, roads, paths and bridges.
- Develop plans to provide basic mobility under all conditions. Insure that transport planning takes into account people with special needs (physical disabilities, low incomes, inability to speak the local language, etc.). Work with community organizations to identify their needs and maintain effective communications with vulnerable groups.
- Develop effective ways to maintain information and communication systems among transport system managers, staff and users under normal and extreme conditions. Develop ways to communicate with residents and travelers under emergency conditions.
- Develop ways to prioritize transport system resources when necessary. For example, design systems to allow emergency, service and freight vehicles priority over general traffic. Maintain contingency plans to allocate fuel and other resources in emergencies.
- Maintain ongoing transportation systems evaluation to provide early detection of possible problems and inefficiencies.
- Design critical components of the transportation system to be fail-safe, self-correcting, repairable, redundant and autonomous. For example, where possible use roundabouts instead of traffic signals, since they function without electricity.
- Cross-train staff to perform critical management and repair services.
- Encourage efficient use of resources, including energy conservation and accessible land use.

Disaster Transportation Issues

Disasters can present various transportation issues:

- Evacuations before, during or after an event, and adequate accommodation of evacuees at refuge destinations.
- Delivery of emergency supplies and services, including water, food, medical care, utility maintenance, law enforcement, etc.
- Search and rescue operations.
- Quarantine.
- Transportation infrastructure repair.

Many disasters involve a variety of catastrophes, such as an earthquake that causes fires and toxic chemical release. Specific transportation issues vary depending on the type and scale of disaster, as summarized below. Major disasters often have dispersed impacts and therefore require regional planning and coordination, since disasters do not recognize jurisdictional boundaries.

Table 2 Major Transportation Issues

	Geographic Scale	Warning	Evacuation	Emerg. Services	Search & Rescue	Quarantine	Infrast. Repair
Hurricane	Very large	Days	✓	✓	✓		✓
Earthquake	Large	None	✓	✓	✓		✓
Tsunami	Very large	Short	✓	✓	✓		✓
Flooding	Large	Days	✓	✓	✓		✓
Forest fire	Small to large	Usually	✓	✓	✓		✓
Volcano	Small to large	Usually	✓	✓	✓		✓
Blizzard/ice storm	Very large	Usually		✓	✓		✓
Building fire	Small	Seldom		✓	✓		
Explosion	Small to large	Seldom	✓	✓	✓		✓
Radiation or chemical release	Small to large	Sometimes	✓	✓	✓	✓	
Plague	Small to large	Usually		✓		✓	
Riot	Small to large	Sometimes	✓	✓			
War	Small to large	Usually	✓	✓			✓
Landslide or avalanche	Small to medium	Sometimes	✓	✓	✓		✓

Different types of disasters present different types of transportation issues.

Evacuation activities can vary depending on the type and scale of disaster. Some disasters require mass evacuations. Others, such as earthquakes and fires, require evacuation from collapsed structures to local hospitals and shelters. Even a small building fire, such as an apartment building, might require evacuation of residents to hospitals and temporarily shelters. Emergency transportation and public transit services are therefore an important component of all emergency preparedness efforts.

Role of Automobile Transportation

Some critics argue that the best way to improve emergency transportation is to increase automobile ownership. For example, in a message distributed soon after Katrina hit, Randal O'Toole (2005) pointed out that automobile transport allowed most families to evacuate New Orleans with relative convenience and comfort, and so argues that the best way to help residents left behind is to subsidize their car ownership. But such arguments ignore several important points (Litman, 2005).

- Many people cannot drive an automobile, even if they own one, due to physical or mental disabilities, age, drug or alcohol addiction, legal restrictions, or other problems. Encouraging such people to drive is impractical, and risky for them and other road users.
- Many vehicles, particularly the older vehicles typically owned by lower-income people, tend to be unreliable and unsafe. Even people who own a car need backup transport options.
- Automobiles cannot be used in some disaster situations. Many cars were trapped in New Orleans by floodwaters, or became inoperable when they ran out of fuel. Earthquakes often damage highways and bridges (Giuliano and Golog, 1998).
- Increased automobile ownership would exacerbate traffic congestion. The evacuation of New Orleans may have failed had another hundred thousand vehicles been on the roads.
- The reduction in hurricane deaths cited by O'Toole has been offset many times over by increased automobile traffic deaths.
- Even people who own an automobile and normally drive may become non-drivers temporarily due to mechanical, medical or economic conditions.

O'Toole also argues that it would be cheaper to purchase cars for nonmotorists than to build the New Orleans streetcar system, but his accounting ignores many costs (operating expenses, parking, road capacity, crash damages, etc.), and the used vehicles he proposes purchasing would require frequent repairs and only last a few more years, compared with the 20-40 year operating life of a train and 50-100 years of a rail line. The gift of a "free" car can be a curse to financially struggling families since it adds thousands of dollars in annual expenses. For a minimum wage worker, \$2,500 annual vehicle operating expenses for insurance, fuel and repairs represents nearly a quarter of their income. At \$3,500 annually (\$1,000 in capital costs and \$2,500 in operating costs), providing automobiles to 100,000 New Orleans households that lack vehicles would cost \$350 million, not counting indirect costs such as additional road and parking capacity. This is more than three times the total regional transit agencies budget.

Described differently disaster response requires *mobility*. Automobiles are one way of providing mobility that is effective in some situations but has high total costs and constraints that prevent it from being useful in some situations and for some people, particularly those most vulnerable. Although it makes sense to increase automobile affordability through true cost saving strategies such as carsharing and Pay-As-You-Drive vehicle insurance ("Affordability," VTPI, 2005), it is a mistake to assume it is always the most appropriate or cost effective solution to every transportation problem.

Best Practices

Automobile transportation can be an important component of disaster response. Transport planners must give motorists directions, and in some cases provide counterflow highway lanes and other special traffic management. It can also be important to coordinate vehicle rentals, emergency repair services and fuel supplies.

But automobile transport alone is inadequate because some people do not have an automobile, or road conditions limit vehicle traffic. Buses are important for transporting people who cannot drive, and for situations where roads are congested or fuel supplies limited. Emergency planners should therefore work closely with transit agencies, school bus service providers and private charter and freight companies to develop action plans.

Emergency transportation action plans can include:

- Communication and support networks that serve the most vulnerable people. This involves a system to identify and contact vulnerable people, provide individualized directions for their care and evacuation, and establish a chain of responsibility for caregivers
- Planning to allow quick deployment of buses, vans and trains. This requires an inventory of such vehicles and their drivers, and clearly established instructions for their use.
- A system to prioritize who should be evacuated first, based on factors such as geographic location and individual needs.
- Information on pickup locations and routes distributed to at-risk populations and all officials. This information should be distributed regularly, not just during major emergencies.
- Instructions on what evacuees should bring, and help for carrying baggage.
- Coordination of fuel, emergency repair and other support services.
- Priority given to buses and other high occupancy vehicles where bottlenecks occur or critical resources are limited.

Developing communication and support networks that serve vulnerable people requires effective community outreach. Each neighborhood should have an inventory of people who may need assistance, ways to contact them, directions for their evacuation, and a list of their friends and family who can provide emergency support. If possible, social service agency staff or volunteer community leaders should travel with vulnerable evacuees to provide information and reassurance to people who may be frustrated and frightened. Implementing such a system requires that planning professionals work with a broad range of community groups, professionals and social service organizations.

There are often many years or even decades between major disasters. As a result, institutional memory may be lost. Experienced emergency managers may move or retire. It is therefore important to document successes and failure after such events, and update emergency plans while the experience is still fresh.

Conclusions

Hurricane Katrina evacuation was relatively effective for people with automobiles, but failed people who rely on public transportation, causing death, suffering and indignity. We can learn from this failure. Transport planners can help prevent future disasters by demanding that emergency response plans devote at least as much attention to non-automobile evacuation as to automobile-based evacuation. Automobile transport may not be as effective in some disaster situations, so even areas with good automobile-based transportation systems require alternative transport systems capable of handling massive evacuations and providing emergency services.

Non-drivers include many people with various physical, economic and social problems. Planners need to anticipate their needs. This may require special community outreach and communications activities to build understanding and trust among planners and the people they serve.

From a transport planning perspective, the greatest mistake in New Orleans was the lack of a detailed action plan to dispatch buses for evacuating transit-dependent residents. Such a plan would include an inventory of all available buses and essential staff, and pre-established procedures to deploy buses when an evacuation order is announced. The plan should include designated collection locations, guidelines as to what each evacuee should bring with them, reliable communication networks, and roadway management to give buses and other service vehicles priority in traffic. Extra effort should be made to provide comfort to evacuees, for example, by having public officials and community volunteers accompany evacuation buses to provide physical and emotional support. Had such a plan been implemented more residents would have evacuated, lives would have been saved, unnecessary suffering avoided, and total costs reduced.

It is important to understand why many people ignored evacuation orders. Many faced logistical or financial barriers obtaining transport out of the city. Many had nowhere to go and were fearful of emergency shelter conditions. Some stayed to protect their property or pets, or out of bravado. Addressing these objections would increase evacuation rates.

The transportation problems exposed by Hurricane Katrina are simply an extreme example of the day-to-day problems that non-drivers face in many communities, due to inadequate and poorly integrated public transportation services. Transportation professionals can play an important role in creating a more efficient and equitable transportation system that accommodates the needs of disadvantaged people and functions efficiently under unusual conditions. It would be helpful for all transportation professionals to spend at least two weeks each year without driving so they can directly experience the non-automobile transportation system that they help create.

A variety of planning policies and programs can help create a more resilient transportation system. These increase system diversity and integration, improve user information, prioritize use of infrastructure, and provide special services during emergencies. These can benefit everybody in a community, even people who currently rely on automobile transportation.

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