Case Studies of the Access and Mobility Impact of Freeway Removal

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Abstract:
Throughout the United States, there is a growing movement to remove selected sections of freeways from city centers. Largely seen as a way to restore life and vitality to these areas, this strategy has the potential for numerous benefits including: 1) eliminating a physical and psychological barrier that divides city neighborhoods, 2) opening up land for redevelopment, 3) removing an aesthetic eyesore that takes away from a city's character, 4) providing direct access to city businesses by restoring road networks and enhancing traffic circulation patterns.

Even though the aforementioned benefits are intriguing by themselves, this concept also has the potential to reduce carbon emissions and improve air quality within these cities. Removing freeways decreases total vehicle miles traveled by promoting walking, biking and mass transit use. Therefore, freeway removal can be seen as another mechanism to contend with the growing environmental issues facing the world.

A handful of freeway sections have been removed or relocated from some cities within the United States and abroad. These cities provide a unique opportunity to investigate how such a major undertaking affects access and mobility of all transportation system users. A surprising view that has emerged is that removing these freeway sections has not resulted in traffic disruption as conventional theory would suggest. Instead, it appears that the overall traffic volume in many of these areas has actually decreased. Much speculation exists as to the cause of these counterintuitive observed outcomes, but the underlying mechanisms are still largely not understood. In order to obtain a more complete model of the effects on the overall transportation system of freeway removal, a detailed analysis of the changes in access and mobility, before and after the freeways were removed, is being performed in our study. Freeway removal projects in 9 cities are listed below as potential candidates for this project.

1. San Francisco, CA
2. Milwaukee, WI
3. Chattanooga, TN
4. Portland, OR
5. New York City, NY
6. Seoul, South Korea
7. Toronto, Canada
8. Boston, MA
9. Paris, France

In this paper we summarize the scope and outcomes of these freeway removal projects.

Case 1: San Francisco, CA – Embarcadero Freeway

Background Information

The Embarcadero Freeway was a double deck freeway spur constructed in 1958, which carried approximately 60,000 cars per day at its peak. In 1989, the freeway was severely damaged by the Loma Prieta earthquake. The damage caused the freeway to be closed and, since no major traffic issues resulted from this closure, the 1.2 mile long freeway spur was ultimately removed in 1991. The removal of this freeway opened up the city to the historic waterfront and provided many opportunities for redevelopment of the area. A landscaped boulevard, called The Embarcadero, along with a pedestrian promenade replaced much of the right of way previously occupied by the freeway. This change significantly enhanced access to the waterfront. A trolley line was also added which connected downtown San Francisco and Fisherman's Wharf. Additional development included remodeling of the historic Ferry building (vacant for years prior to demolition of the freeway), construction of a multi-block retail and office center, development of the Rincon Hill and South Beach residential neighborhoods, and development of new recreational parks.[1] The replacement six lane boulevard carries approximately 26,000 cars per day (as of 2000). The trolley line that was added carries approximately 20,000 people per day based on 2000 data.[2]

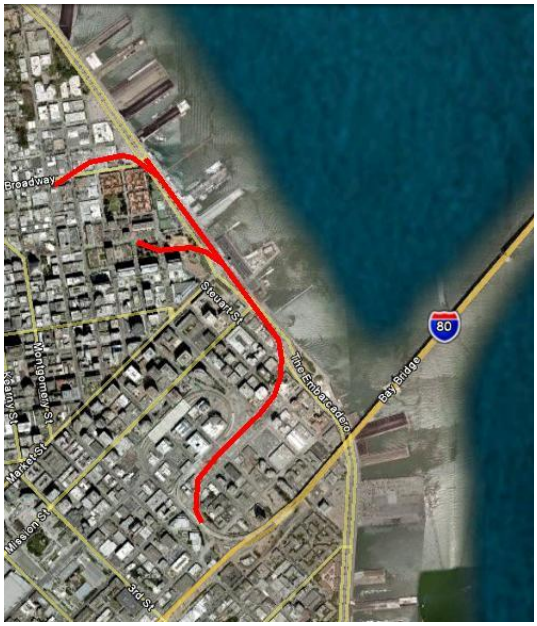

Figure 1: Embarcadero Freeway Overlaid on Current Map
(Source: Google Earth)

Figure 2: Before and After Freeway Removal
(Source: www.flickr.com/photos/v63/228932719/)

Results

Removing this freeway did not result in gridlock as was originally feared. Traffic was successfully absorbed on alternate routes to and from the Bay Bridge. Ferry ridership service has increased with improved access to the Ferry building and the waterfront and the addition of the trolley line significantly increased transit use in the area. Approximately 7,000 additional housing units are either built or under construction in the land made available by demolition of the freeway.[2]

Case 2: San Francisco, CA – Central Freeway

Background Information

The Central Freeway was a 0.8 mile long elevated freeway spur constructed during the 1950s. At its peak, the freeway carried approximately 93,000 cars per day. The freeway was a four lane, two-level structure. Similar to the Embarcadero Freeway, the Central Freeway was severely damaged by the Loma Prieta earthquake in 1989 and removed between 1992 and 2003. The freeway was replaced by a surface boulevard which carries approximately 45,000 cars per day and consists of four lanes for through traffic and two service lanes for local traffic and bicycles (separated from the through lanes by a landscaped median and a sidewalk). Demolishing this section of the freeway also opened up the Hayes Valley Neighborhood to redevelopment. Additional housing, public parks, and mass transit were included as part of the redevelopment and parking was intentionally limited to make the area more pedestrian and mass transit friendly.[3]

Figure 3: Central Freeway Overlaid on Current Map
(Source: Google Earth)

Results

As was similar with the Embarcadero Freeway, traffic gridlock did not occur when this freeway was demolished. Crime levels dropped in the Hayes Valley neighborhood and property values rose substantially in the area. In 1996, the average price of a condominium in the area was $203,000 or 66% of the San Francisco average. In 2006, the average price of a condominium in the area was $760,000 or 91% of the San Francisco average. Approximately 1,000 new housing units were either constructed or planned for the area and a 16,500 square foot park was constructed with revenues from sales of freeway parcels. However, peak hour congestion on the boulevard results in backups on adjacent surface streets which have caused bus delays of as much as 2.5 minutes. Also, collisions between cars and bicyclists have become an issue in some areas due to flaws in the final design.[2]

Figure 4: View of Central Freeway Before and After Demolition
(Source: The Preservation Institute)

Case 3: Milwaukee, WI – Park East Freeway

Background Information

The Park East Freeway was a 0.8 mile long elevated freeway spur constructed in 1971 that carried approximately 54,000 cars per day. This freeway was a physical barrier separating the north side of the city from the downtown area. This freeway limited access to downtown by only having three exits and interrupting the street grid network. The result was that traffic was forced into just three intersections. By the late 1990s the freeway was nearly 30 years old and in need of significant repairs. The cost of the repairs was estimated to be $100M while demolishing the freeway only cost $25M. The success of nearby redevelopment, the high cost of repair, and the low traffic volume of this road helped convince the Governor to proceed with demolishing it between 2002 and 2003.[4] The freeway was replaced by McKinley Boulevard which is an at-grade four lane road that has reconnected the street network.[5] The replacement boulevard carries approximately 15,800 cars per day based on a 2007 study.[6]

Figure 6: Park East Freeway Overlaid on Current Map (Source: Google Earth)

Figure 5: Park East Freeway Before Demolition (Source: The Preservation Institute)

Figure 7: Park East Freeway After Demolition (Source: "Walker Proposes Selling County's Park East Land to City", 2009, www.biztimes.com)

Results

The boulevard is still fairly new so many of the redevelopment plans for the area are still in the planning process. However, the Fortune-500 Manpower Corporation moved their headquarters to the area and mixed-use developments are beginning to spring up. Between 2001 and 2006, the average land values per acre increased approximately 180% in the area. Approximately, $340M in redevelopment projects are either under review or have been approved and more projects are in the proposal process.[4]

Case 4: Chattanooga, TN – Riverfront Parkway

Background Information

Riverfront Parkway was constructed in the 1960s as an at-grade four-lane freeway intended for use by heavy trucks serving points along the river. This freeway divided downtown Chattanooga from the waterfront. At its peak, the freeway carried approximately 20,000 cars per day, 13,000 of which were heading to or coming from Chestnut Avenue for downtown access. In the 1980s, the city tried to improve its public image by improving the quality of its downtown area and its connection to the riverfront. The project at the forefront of the revamping of the city's image was the redesign of the Riverfront Parkway. The parkway redesign matched the road to the urban context by including a two-lane section for enhanced pedestrian safety and a four-lane boulevard section for automobile access to the city. Significant improvements were also made to the adjacent street grid network and recreational parks were constructed along the boulevard. The Riverfront Parkway redesign was completed in 2004.[2]

Figure 8: Riverfront Parkway Overlaid on Current Map (Source: Google Earth)

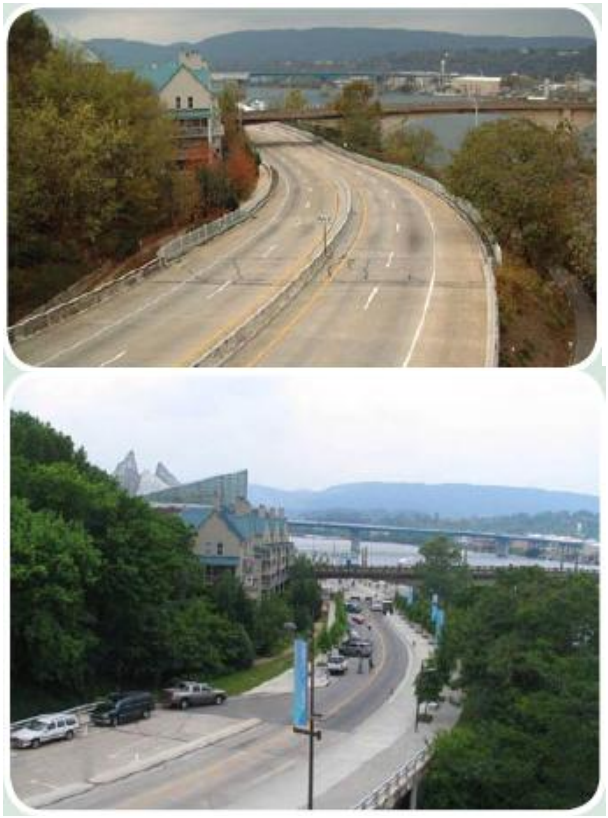

Figure 9: Riverfront Parkway before and after Redesign (Source: Glatting Jackson)

Results

A new riverfront park and event area was created which attracted more people to the area. The new roadway was safer for pedestrians thereby giving them great access to these new attractions. Connections to the downtown area increased from two intersections to six that distributed the traffic more evenly thereby reducing the overall congestion in the area. The area has become very popular and is now a strong possibility for additional redevelopment opportunities that could bring further benefits to the area.[2]

Case 5: Portland, OR – Harbor Drive

Background Information

The Harbor Drive freeway was constructed in 1942 as a four lane, three mile long, at-grade road that ran alongside the Willamette River connecting an industrial neighborhood, Lake Oswego, and areas south of the downtown area. It served as a physical barrier between the downtown area and the waterfront and carried approximately 25,000 cars per day at its peak. By 1968, residents were looking for more open space along the waterfront, so a study was initiated to determine if the freeway could be removed. The proposal to close the freeway gained more support when I-405 was completed in 1973 and linked to I-5. In 1974 the freeway was ultimately closed and demolished to make way for the construction of a 37 acre waterfront park.[2]

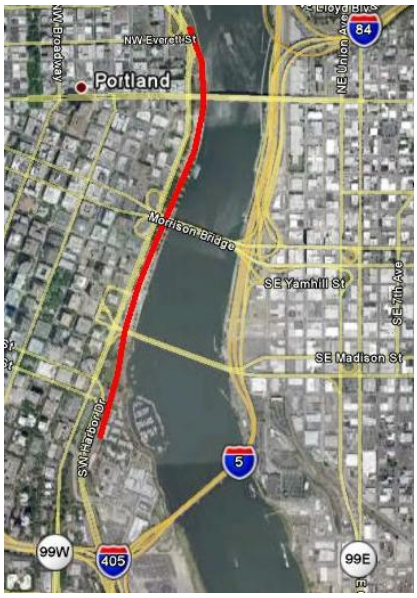

Figure 10: Harbor Freeway Overlaid on Current Map
(Source: Google Earth)

Results

The removal of this freeway was part of a comprehensive plan to better manage traffic within the city. Other parts of this plan included converting all the streets in downtown to one-way, synchronizing traffic lights throughout the area, and decreasing speed limits. When the freeway closed, no discernible negative effects to the traffic flow in the surrounding areas were evident. In addition to the 37 acre waterfront park, three other major mixed-use development projects were completed in the area which brought increased tax revenue to the city. Property values in the area have also increased substantially since the freeway was removed. In 1974, 75% of the properties in the area were worth the same or less than the land on which they sat. By 2002, the property values had tripled and property value growth in this area increased faster than that of the rest of the city of Portland by 7%. Crime has also been reduced significantly in the area. The redevelopment area crime rate has decreased 65% since 1990 versus a 16% reduction in the city as a whole.[2]

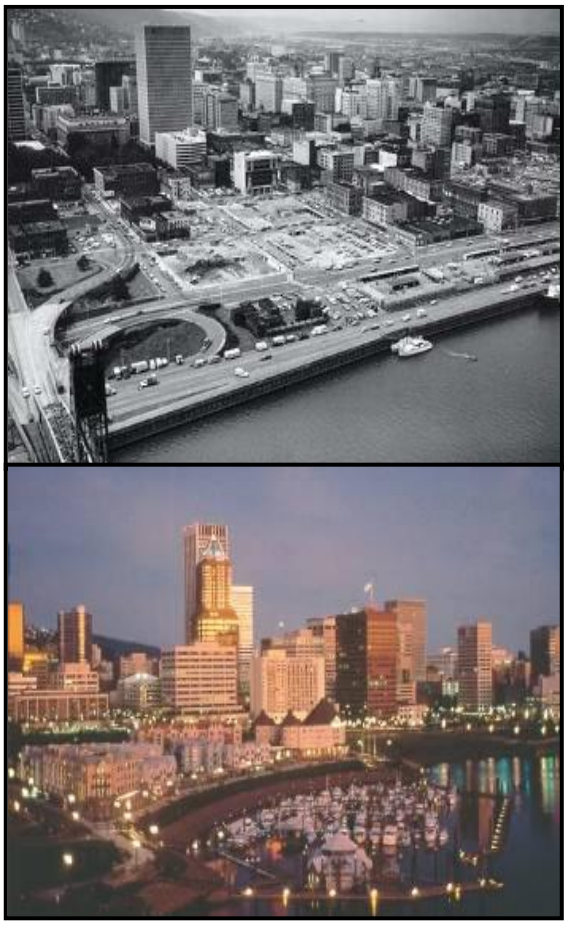

Figure 11: Harbor Drive Area Before and After Demolition
(Source: www.theinfrastructurist.com)

Case 6: New York City, NY – West Side Highway

Background Information

The West Side Highway was constructed in 1948 as a six-lane freeway that ran approximately 5.1 miles south along the Hudson River from 72nd Street to where it connected to the Brooklyn Battery Tunnel.[7] The highway was an elevated structure that ran over the at-grade West Street and provided a physical barrier between New York City and the waterfront. The highway carried approximately 140,000 cars per day at its peak.[8] By the 1960s, the highway had been significantly degraded by salt and pigeon excrement and badly needed an overhaul. Part of the highway collapsed in 1969 but was quickly repaired. However, in 1973 a cement truck on route to make a repair on another section of the highway caused a 60 foot section of the highway to completely collapse, which closed the section of the highway between the Battery Tunnel and 57th Street until a solution could be determined. Demolition of the unsafe elevated structure began in 1977 and was completed in 1989. The city decided in 1993 to simply improve the existing West Street (the street underneath West Side Highway) by adding 19 foot wide landscaped medians, a bicycle path, a landscaped park along the river, and other urban design elements (i.e. decorative street lights, granite paving paths, etc) which enhanced the connection between the street and the park. This project was completed in 2001. West Street has between three and four lanes in each direction.[7] Depending on the section of the road, West Street carries between 65,000 and 139,000 cars per day.[9]

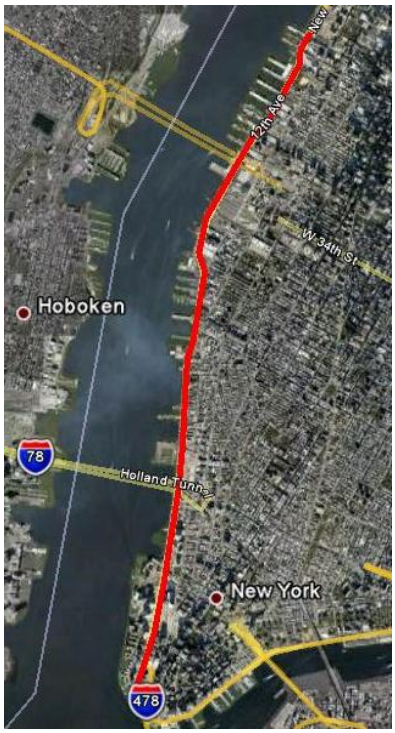

Figure 12: Westside Highway Overlaid on Current Map (Source: Google Earth)

Results

When the highway closed in 1973, 53% of the traffic that utilized the corridor disappeared thereby reducing the total traffic volume in the area. Unfortunately, removing the West Side Highway opened up minimal land for redevelopment. The highway was located above a wide existing street, so only a small amount of land was made available by demolishing entrance and exit ramps. This land, however, was used to create a new waterfront park and it opened up the city to the waterfront with the addition of more pedestrian and bicycle friendly surroundings.[7]

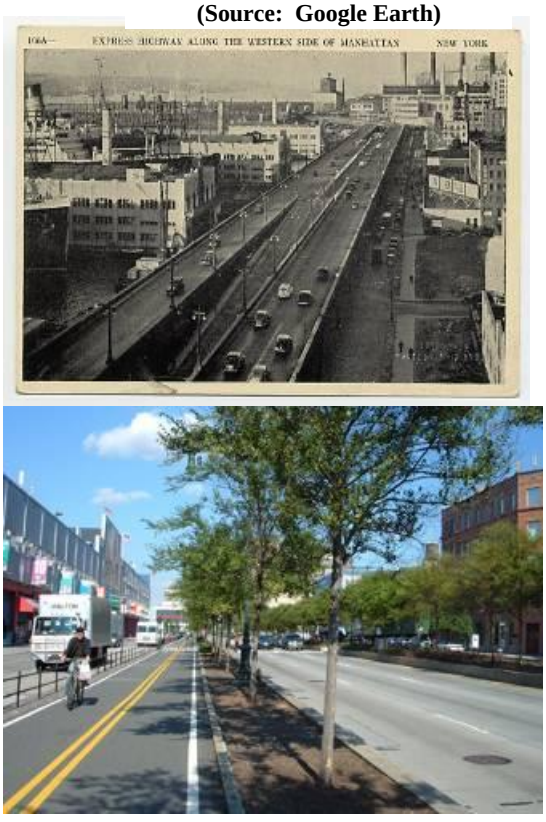

Figure 13: Westside Highway Before and After Demolition (Source: The Preservation Institute)

Case 7: Seoul, South Korea – Cheonggye Freeway

Background

Between 1958 and 1976, the Cheonggyecheon ("clear valley stream") was put underground. This allowed for the construction of the Cheonggye Elevated Highway and the Cheonggye Road above it in the 1970s. The elevated freeway section was four lanes wide and approximately 3.6 miles long. There were also four additional lanes of traffic in each direction on the at-grade portion of the road. At its peak, the combined traffic count on both roads was approximately 168,000 cars per day (60% of which was through traffic). Initially, this freeway was seen as a symbol of South Korea's progress in coming into modern times. However, four decades later, the freeway came to be known as the most noisy and congested section of the city. In order to revitalize this section of the city, the roads were removed between 2003 and 2005. The formerly covered stream now became the centerpiece of a 3.6 mile linear park. Two one-way streets were also installed on either side of the stream. The removal of this freeway, however, was just one part of a larger comprehensive traffic management plan enacted by the city. In 1996, the city began charging tolls for private vehicles with less than three passengers to enter the city at peak times. In 1997, the city began making regular fee increases for parking. A "No Driving Day" program was established in 2003 which gave drivers discounts on tolls and car services in exchange for not driving into the city one weekday per week. Gas taxes were increased and an incentive-based traffic demand management program was established with local employers. Finally, the city's bus system was completely restructured in 2004 which included a network of median bus-only lanes and coordinating fares and schedules with the subway system.[2]

Figure 14: Cheonggye Freeway Before and After Removal
(Source: City of Seattle)

Results

The new park attracted approximately 90,000 visitors per day in the 15 months after it opened, 30% of which were from outside the metropolitan area. In a 2005 study, it was found that adjacent land parcel values increased by an average of 30% since the freeway was removed. After the comprehensive traffic management plan was fully implemented, traffic going into the downtown area decreased by 9%. An unexpected environmental benefit came when it was found that temperatures in the area adjacent to the stream were seven degrees (F) cooler than at locations a quarter mile away. In terms of economics, the Seoul Development Institute has estimated long term benefits in the form of $8.5 to $25 billion and approximately 113,000 new jobs thanks to the revitalization of the Cheonggyecheon.[2]

Case 8: Toronto, Canada – Gardiner Expressway East (Scarborough Expressway)

Background Information

Constructed between 1956 and 1966, The Gardiner Expressway East was a six lane, 0.8 mile long elevated structure that ran above the six lane at grade surface street called Lake Shore Boulevard. It served as a physical barrier between the city of Toronto and the waterfront. This freeway was primarily used to connect to the Gardiner Expressway for access to downtown Toronto and the industrial waterfront. Shortly after the freeway was constructed, the industrial functions along the waterfront began to decrease as industry moved to cheaper land outside the city that had been made accessible by the construction of other freeways during this time period. This led the city of Toronto to start planning ways of revitalizing the harbor area. The start of this redevelopment plan was to demolish the Gardiner Expressway East. The city came to realize after studying this in the 1990s that it would be more expensive to keep the freeway up than to simply tear it down. Between 2000 and 2002, the freeway was demolished and replaced with an improved Lake Shore Boulevard.[10]

Figure 15: Gardiner Expressway East Demolition Boundary (Source: "Removing Toronto's Elevated Expressway One Piece at a Time: Dismantling the F.G. Gardiner Expressway East)

Figure 16: Gardiner Expressway East Before and After Demolition (Source: "Removing Toronto's Elevated Expressway One Piece at a Time: Dismantling the F.G. Gardiner Expressway East)

Results

Despite fears of traffic gridlock, no significant increases in traffic congestion have been experienced in the area. The city of Toronto has plans to utilize this area for mixed-use purposes which would infill the area with additional housing, commercial buildings and recreational areas. Another critical part of this project was the construction of a bicycle and pedestrian bridge running over the Don River. Since the Don River is a very busy transportation corridor, the addition of this bridge provided safe and efficient access for bicyclists and pedestrians to areas across the river.[11]

Case 9: Boston, MA – Central Artery

Background Information

Constructed in 1959, the Central Artery was a six lane elevated freeway that divided the downtown financial district from the waterfront. At its peak, this freeway carried approximately 190,000 cars per day. Unfortunately, it contained several significant design flaws such as twenty-seven on and off ramps and a lack of merge and breakdown lanes that caused congestion. Funding was secured to move the freeway underground (The Big Dig) in the 1980s to relieve the traffic congestion. By the time construction was ready to begin in the 1990s, the Central Artery had an accident rate that was four times the national average. In 2003, the freeway was demolished and moved underground. The land was used to repair the street grid network with surface boulevards. Also, four parks were constructed on freed up land between the waterfront and downtown.[12]

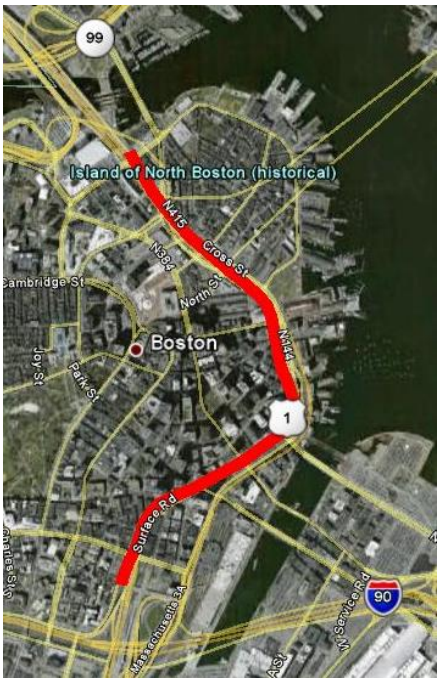

Figure 17: Central Artery Overlaid on Current Map
(Source: Google Earth)

Results

This project did remove an elevated freeway from the downtown area; however the total vehicle capacity was actually increased by this project by approximately 60,000 cars per day. The cost of this project was approximately $15 billion, which was about five times the estimate cost. Because of the excessive costs, some aspects of the project that would have improved mass transit were ultimately cut. However, numerous benefits were still evident. A 2004 study in the Boston Globe found that since the project began, commercial property values in the area increased 79% compared to 41% for the city as a whole. Additionally, a 2006 study by the Massachusetts Turnpike Authority found that a substantial level of private investment has come as a result of this project. Approximately $5.3 billion in projects recently completed or underway are within a five minute walk of the project area. These projects include 4,200 housing units and are estimated to create 36,000 new jobs.[2]

Figure 18: Central Artery Before and After Demolition
(Source: Tufts University)

Case 10: Paris, France – Georges Pompidou Expressway

Background Information

The Georges Pompidou Expressway is a two-lane at-grade freeway constructed in 1967 along the east bank of the Seine River that carries approximately 70,000 cars per day. It is a physical barrier between the city and the waterfront of the Seine. This freeway is primarily used for travel to and from the center of Paris. In 2001, Bertrand Delanoe was elected mayor of Paris based on a platform of support for public transportation, walking and bicycling. In the summer of 2002, the City decided to turn the freeway into the Paris Plage (Paris Beach) in order to attract more people to the area. In order to create this place, the City closed the street 24 hours a day between July 21 and August 18, $1.5 million euros was spent to bring in palm trees, beach umbrellas, beach chairs, an outdoor climbing wall, outdoor cafes, refreshment stands, bicycle rentals and enough sand to create some sections of sandy beach.. Approximately 1.7 miles of the expressway was closed for the beach. Because of its success, the closure of the freeway has become an annual event and talks have begun to make a permanent closure of the freeway.[13]

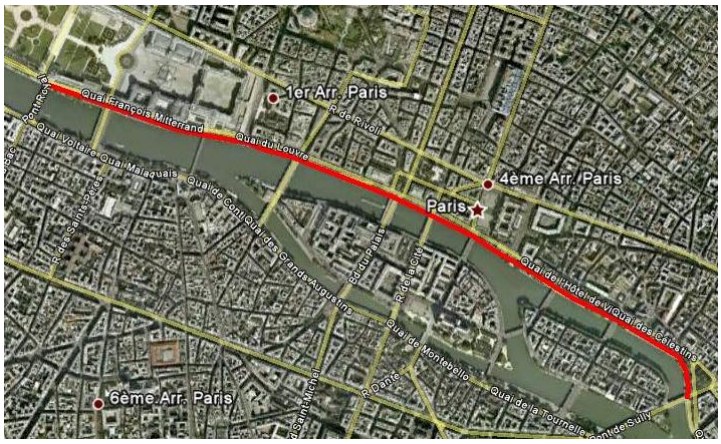

Figure 19: Georges Pompidou Expressway (Source: Google Earth)

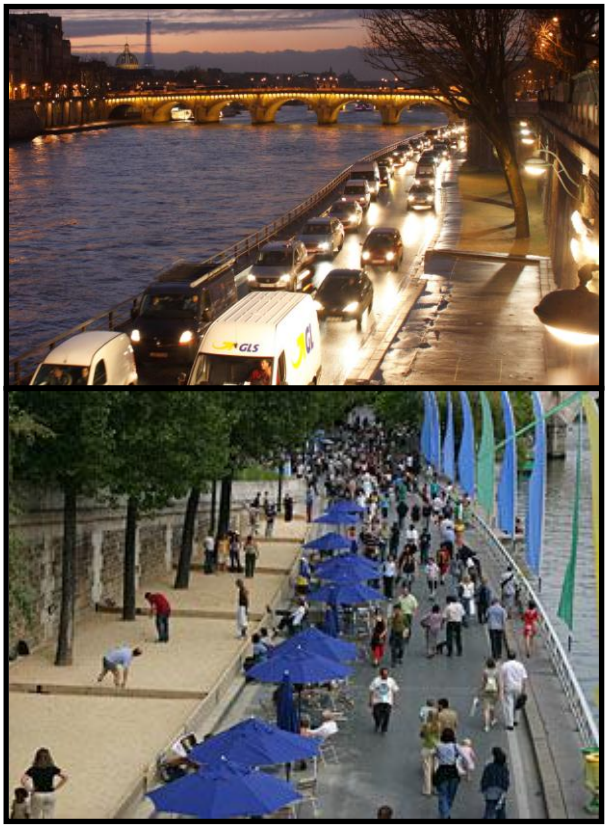

Figure 20: Before and After Paris Plage (Source: www.flickr.com and Project for Public Spaces)

Results

On the first day the Paris Plage was open, it attracted approximately 600,000 visitors. Throughout the rest of the month, it attracted 2 million visitors. No significant traffic problems in the surrounding area were evident during this time; however traffic is normally lower between July and August because it is the vacation season for Parisians. No specific economic data was immediately available, but it is likely that significant economic benefits have been experienced in the area. The closure of the Pompidou Expressway was part of a larger comprehensive plan to reduce automobile use and reduce greenhouse gas emissions throughout the city. This plan included installing bus-bicycle-taxi only lanes (no automobiles) and a new tramway line.[13]

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[12] "History of the Central Artery/Tunnel Project", http://www.masspike.com/bigdig/background/history.html
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CASE STUDIES OF THE ACCESS AND MOBILITY IMPACT OF FREEWAY REMOVAL

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Goals
- Restore vitality to city centers
- Improve transportation system efficiency

Objectives
- Eliminate physical and psychological barriers that divide cities
- Open up land for commercial and residential redevelopment
- Restore vital road network connections
- Decrease carbon emissions

Types of Freeway Removal
- Replace with surface boulevard
- Relocate freeway underground
- Close freeway / use for other purposes

Potential Case Studies
- San Francisco, CA – Embarcadero Freeway
- San Francisco, CA – Central Freeway
- Milwaukee, WI – Park East Freeway
- Chattanooga, TN – Riverfront Parkway
- Portland, OR – Harbor Drive
- New York City, NY – West Side Highway
- Toronto, Canada – Gardiner Expressway East
- Seoul, South Korea – Cheonggye Freeway
- Boston, MA – Central Artery ("Big Dig")
- Paris, France – Georges Pompidou Expressway

Project Sponsored By
- New England University Transportation Center

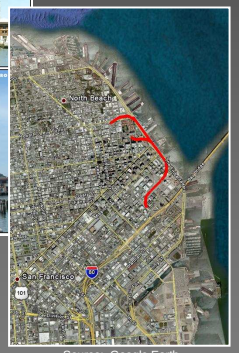
Additional Support Provided By
- Dwight David Eisenhower Transportation Fellowship Program
- University of Connecticut Center for Transportation and Urban Planning
- Institute of Transportation Engineers
- Congress for the New Urbanism

Replace with Surface Boulevard
San Francisco, CA – Embarcadero Freeway

Background Information
- 1.2 mile elevated freeway spur constructed in 1958
- Carried 60,000 cars per day at peak
- Barrier between the city and San Francisco Bay
- Severely damaged during Loma Prieta earthquake in 1989
- Demolished in 1991



Source: www.flickr.com



Source: Google Earth

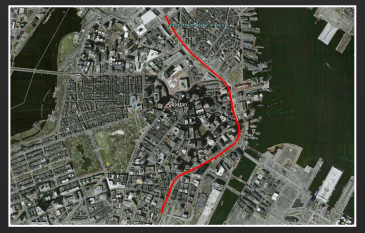
Results
- New boulevard carries 26,000 cars per day
- Traffic absorbed on alternate routes
- New trolley line carries 20,000 people per day
- Increased ferry ridership
- 7,000 housing units planned / built

Relocate Freeway Underground
Boston, MA – Central Artery ("Big Dig")

Background Information
- 1.4 mile elevated freeway section constructed in 1959
- Carried 190,000 cars per day at peak
- Barrier between city and waterfront / divided neighborhoods
- Accident rate 4 times national average, severe traffic congestion
- Demolished in 2007

Source: Tufts University

Results
- Traffic capacity increased to 250,000 cars per day
- Created 300 acres of new parks
- City carbon monoxide levels decreased 12%
- Property values increased 79% (compared to 41% citywide)


Source: Google Earth

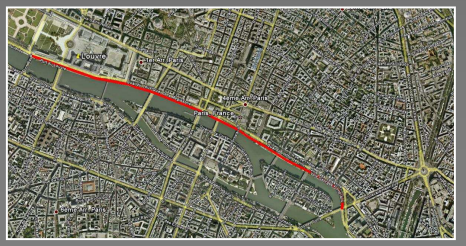
Close Freeway / Use for Other Purpose
Georges Pompidou Expressway – Paris, France

Background Information
- 1.7 mile at grade freeway constructed in 1967
- Carries 70,000 cars per day
- Barrier between the city and the River Seine
- Closed annually from mid-July to mid-August (vacation season)
- Converted into a beach / public space starting in 2002


Source: www.structurae.de


Source: www.flickr.com

Results
- Approximately 3 million visitors annually
- Traffic absorbed on alternate routes with minimal impact
- Led to discussions about permanently closing the freeway
- Economic benefits to businesses in the area



Source: Google Earth