

City Expansion at the Coastline: Case Studies of Florianópolis, BRA, and Boston, USA

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Resumo: O crescimento urbano em virtude da expansão das atividades mercantis em cidades localizadas em regiões costeiras tem enfrentado obstáculos físicos ao longo dos anos. Dessa forma, governos expandiram o zoneamento urbano sobre o mar, objetivando promover a circulação de bens e pessoas que traziam benefícios às cidades, através de atividades econômicas. Procurando entender a problemática da apropriação e uso destes espaços construídos, este trabalho aborda o avanço das cidades sobre as áreas de baías considerando as atividades de preenchimento de terra, denominadas aterros. Esta abordagem é fundamentada na comparação do grau de desenvolvimento urbano e *status quo* dos municípios de Florianópolis – SC - Brasil e Boston – MA – USA. Assim, através da análise de similaridade e contraste entre as duas cidades, verificou-se os aspectos positivos e negativos que definiram os modelos de empreendimento presentes e atuantes.

Palavras chaves: Aterro, Preenchimento de terra, Vias de transporte, Desenvolvimento urbano, Planejamento urbano

Abstract: “Expansion” of coastal cities related to mercantile activity and the demand for land has slowed or stopped because of physical or legal limitations. This paper discusses the expansion of coastal city spaces along the shorelines by “land filling,” referred to in Portuguese as “obras de aterramento”. Expanding commercial space (buildings and piers), improving circulation (harbor and streets), and creating developable residential property increase the potential economic activity of the city. Both similar and unique features can be identified in the two cities in this study (Boston, United States, and Florianópolis, Brasil) that demonstrate how waterfront activities promote waterfront development and anchor the *status quo*. The enterprise model, describing benefit and causality, describes the similarities and distinctions of these contemporary cities.

Keywords: Waterfront, Landfill, Made land, urban transportation, urban development, urban planning, earthwork

Introduction

The growth of the two cities of this study – Boston, US, and Florianópolis, BR – through the years molded the urban form of each city. In particular, space localization, major trade activities, public development policy shaped by the local culture of people and labor demand drove the expansion of the cities and determined the future of each place’s urban development.

In this manner, specialized zones like commercial areas, harbor areas, factory areas and residential areas emerge in different places inside or around the cities. The modern patterns of urban development are results of these kinds of activities.

The presence of the sea in Boston and Florianópolis shaped the expansion of the shoreline and brought with it development and commercial activities linked to port functions. Nearest the harbor zones, the increase in people and goods flow encouraged the establishment of commercial activities and factories, as well as demand for worker housing.

When expansion reached the shoreline and building was as dense as then possible, it became necessary find more space close this area for allow further improvement. The resolution for this problem: filling in low-lying land areas and even building outward into the water.

Boston (Fig 1) and Florianópolis made use of this resource to enlarge their boundaries. Both cities have a large portion of their land over, and beyond, the old shorelines. Large areas of Boston like Back Bay (which will be described more lately in this paper), South Bay, Mill Cove, West and South Cove and Town Cove or Logan Airport are sited on what was water or marshlands just 400 years ago. The same can be said about the Baía Sul, Baía Norte and Via Expressa Sul in Florianópolis. Today Florianópolis and Boston are extremely developed cities with significant acreage development acreage built on fill.

This paper examines what drove waterfront development in each region, showing the processes and technologies applied. The economic periods of each city will also be described in relation to fill activities.

The methods used include a walk of the original shorelines in Boston and Florianópolis, analysis of old aerial photography in Florianópolis and GIS data showing the old shoreline in Boston. The GIS software used was ArcGis version 9.2. Data for Boston was gathered from the Boston Redevelopment Authority, Krieger et al, 2001, and Askew et al, 2002. Data for Florianópolis was available at UDESC's Geoprocessing and Remote Sensing Laboratory.

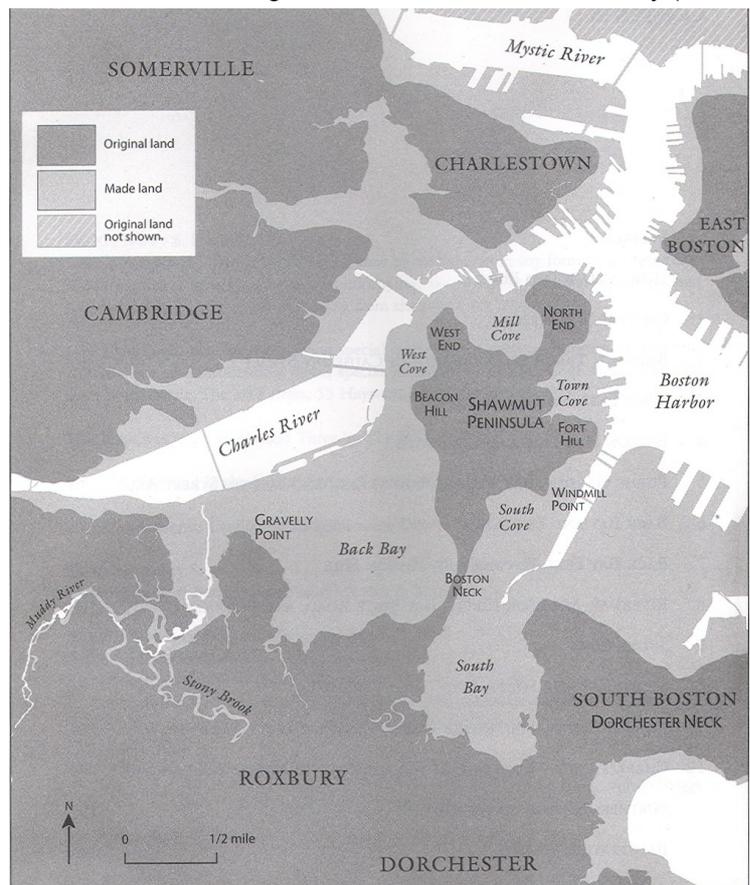


Figure 1 : Change in Boston land area from 1600s to today

1 The need to expand

The town of Boston was founded in 1630 and was little more than an island connected to the mainland by a low-lying, narrow neck, which had space for only one road. A very large tidal marsh lay behind the town, with the Charles River running through it (Newman and Holton 2007).

Since its founding in the colonial period, Boston was a very important harbor that linked North America to Europe and the rest of the world. The China-Boston trade, for example, was enormously profitable and brought prosperity to Boston.

“The China trade was three cornered – New England ships took goods such as clothing and metal tools around Cape Horn to the Pacific Northwest (today’s Washington, Oregon and British Columbia) and traded them there to the Native Americans for sea otter pelts. The ships then carried the furs to China, where they were exchanged for tea, porcelains, and silks, and then transported the Chinese goods around the Cape of Good Hope at the southern tip of Africa – hence circumnavigating the globe – to New England” (SEASHOLES, 2006, p.13)

These factors transformed Boston into an important metropolis in New England and attracted many

gravel. The Back Bay was horribly polluted because sewage emptying into the former tidal marsh, along with dumped refuse, was no longer cleansed by twice-daily high tides. Boston was severely overcrowded, with over a hundred thousand acres, A rapid increase in the poor, and often destitute, immigrant population provided social motivations and led city and state leaders to seek ways of keeping wealthy Protestant families in Boston by creating a new, elegant neighborhood". (NEWMAN; HOLTON, 2007, p.10).

Florianópolis colonization started in the mid-18th century, mostly with the arrival of Portuguese colonists from the Azores Islands. It is composed of one main island, the Island of Santa Catarina, one continental part and the surrounding small islands.

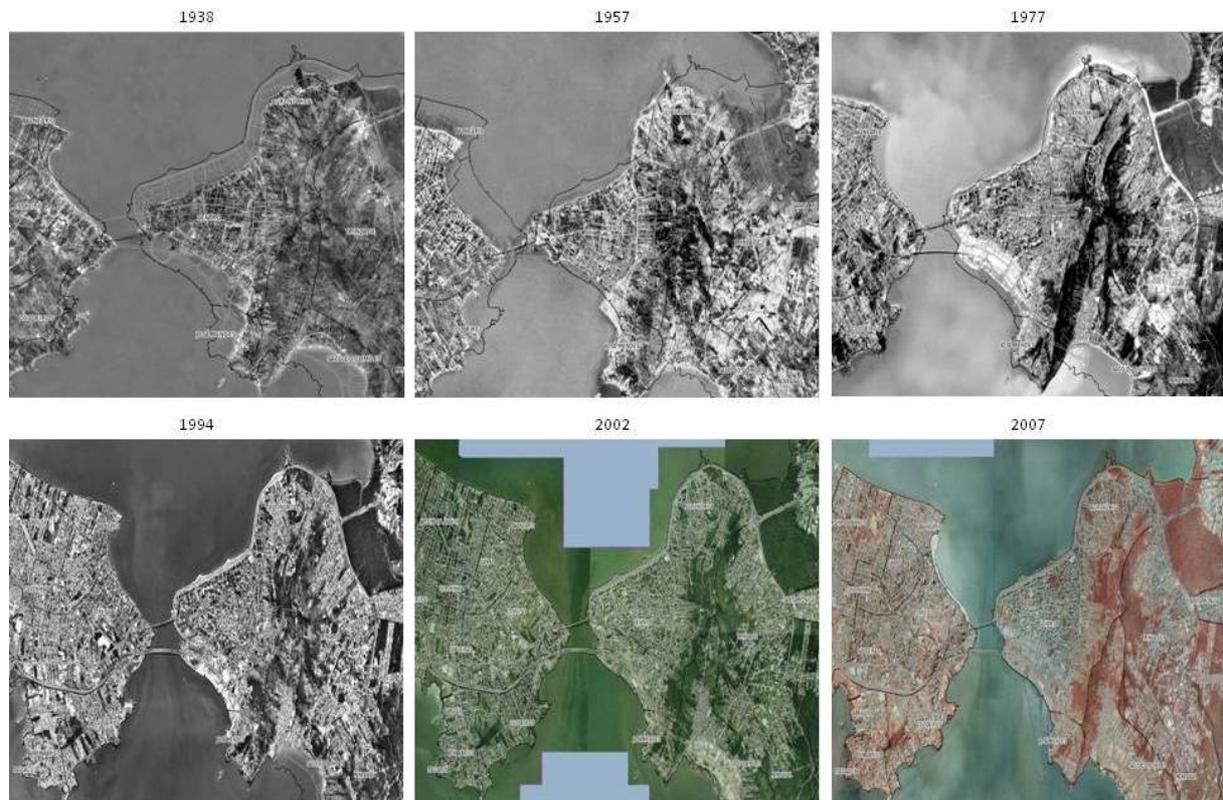
Until 1926, the only connection between the island and the continent was across water, by boat. The main economic activity was fishing during this period. But every trade activity had to use boats for transportation.

In 1926 the Ponte Hercílio Luz (the first bridge between the island and continent) was built, and brought with it a large increase in trade. The primary mode of transportation became cars and trucks. The flow of goods and people continued to swell with the building of a second bridge, the Ponte Colombo Salles. This second bridge permitted even better integration with other Brazilian capitals like Porto Alegre, São Paulo and Curitiba, and with the state interior.

With these improvements in transportation, the daily flow of people and goods and the expansion of merchant and tourism activities (the latter linked with the beautiful landscapes on island) created problems with traffic circulation in central part of the city. The necessity for more space led to land filling proposals.

In 1972 the filling of Baía Sul began with promise of improving urban circulation and linking the continent with additional bridges to north and south of the city center in order to preserve the colonial architecture of old houses and public buildings and keeping the historic parks and Atlantic vegetation intact (Fig 4).

Land evolution on Florianópolis area 1938 – 2007 - Baía Norte e Sul



Land evolution on Florianópolis area 1938 – 2007 – Via Expressa Sul

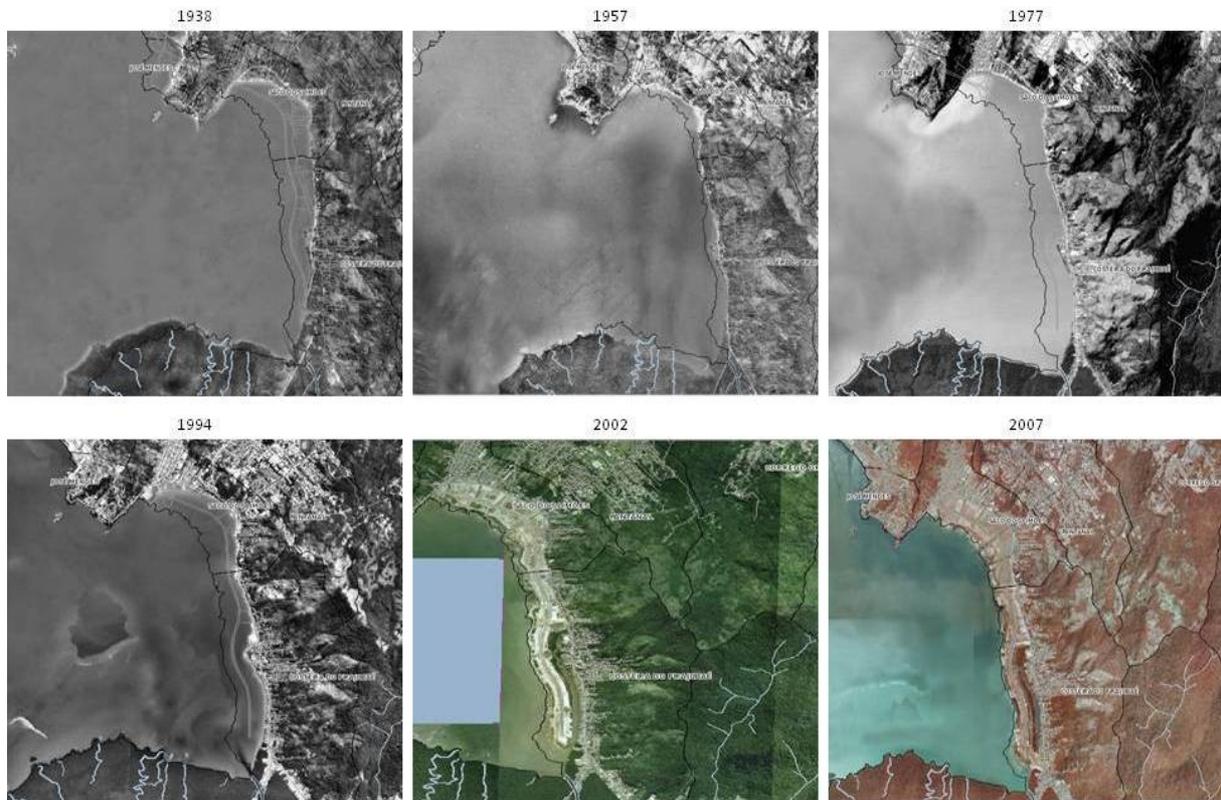


Figure 4 : Evolution of fill activities in Florianópolis, 1938 - 2007

According to Cunha (2005), the first objective of waterfront development would be improve the highway system, expand areas for public buildings, residences, factories, trade establishments and construction of recreational and sports parks. More recently, a similar proposal was put forth to fill an area in northern end of the island called Baía Norte (Fig 5).

Analyzing the causes of behind “made land” in both cities, it’s possible to find commonalties and differences for promoting waterfront building. Both cities are positioned close to the Atlantic Ocean and have relied on the sea as their main source of growth in their early development. The following figure shows these characteristics (Fig 6).



Figure 5: central Florianópolis, circa 1950

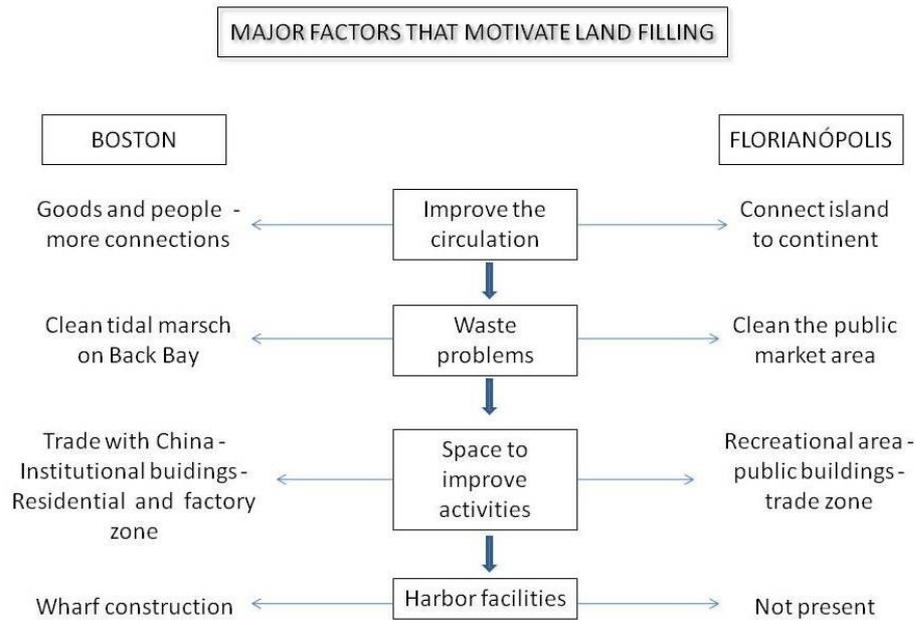


Figure 6 : Major factors that motivate land filling

1.1 Waterfront expansion of the harbor and central city areas

Geographically, the more developed areas of Florianópolis and Boston are on or along protected bays, as well as a number of internal low-lying and/or marshy areas. The downtown central business district and other major functions like the financial district, hotels and trade zone are concentrated in this region. Historically, both cities initial expansion began in these areas, especially at the edges in order to accommodate increasing sea-linked commerce.

“Boston`s population expanded steadily as its maritime trade boomed because of its large, protected harbor and the willingness of its merchants to take big risks in world trade for the chance of huge profits.” (NEWMAN; HOLTON, 2007, p.20).

The key factor was the harbor where most economic activities were focused. To protect the maritime trade, the harbor zones were built in inner well-protected areas in order to minimize dangers related to the weather, reduce the risk of piracy, and allow for better control of shipping traffic entering and exiting the harbor. Calm water also gave access to many different types of ships, and made the loading and unloading of watercraft easier, both from boat to shore and from boat to boat.

Landfilling at the edges expanded the working area and further increased trade activities. This in turn brought more business, more profits and more investment, prompting more enlargement of the urban area in order to accommodate more development as close to the center of activity as possible.

According to Cunha (2005), Florianópolis urban development occupation grew intensively after waterfront construction created a triangular area, between the bridges at one vertex back to the base of the mountains as shown in Figure 7.

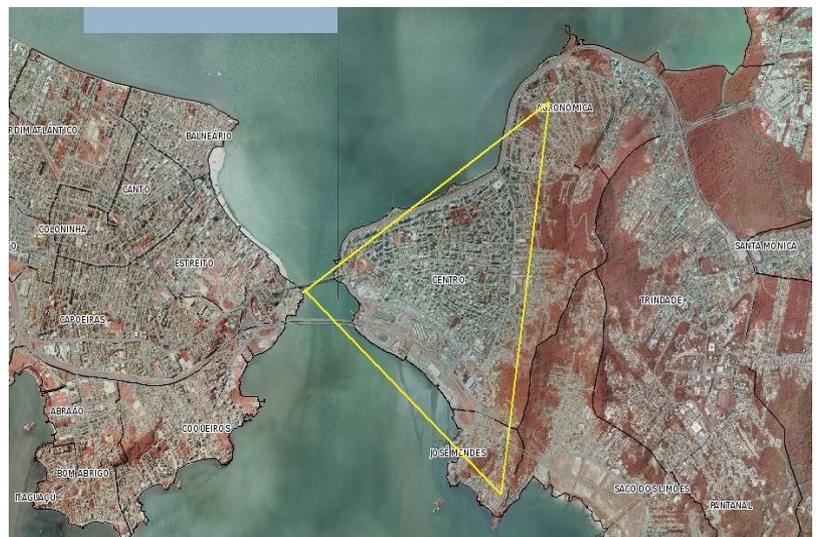


Figure 7 : The Florianópolis triangular area

2 The economy and waterfront construction

For many years, the Boston economy was concentrated in import – export trade, and the fishing industry – an important mainstay not only of the Boston economy but also of many New England ports (Kurlansky, 1998). After independence, Boston became a major shipping harbor and manufacturing center in the country, nearly an equal to New York City until the opening of the Erie Canal (Taafe et al, 1973, pp. 85-93).

The Boston inner harbor was one of the world's biggest international trading sites. The products traded included rum, fish, salt, and tobacco. The trade with China and India brought prosperity to merchants and transformed several families in a social and cultural elite.

In the mid of 1800s manufacturing became an important activity as the Industrial Revolution boomed in the US, and the city's industrial base overtook international trade in economic importance. During the 1900s, Boston was one of the biggest largest manufacturing centers on the country, with production concentrated in garments and leather goods.

Rope production is a good example of the increase in factory activities on Boston area. *“The manufacturing of rope needed for sailing ships and other uses was an important industry in early Boston”* (NEWMAN; HOLTON, 2007, p.20).

Wealth also led to the early founding of educational centers. The city was the site of America's first public school, Boston Latin School in 1635, and first college, Harvard College founded in 1636 in Cambridge. The city's economy diversified to some extent into research and finance activities. Boston is also the seat of the state government and home to a vast array of non-profit agencies and cultural institutions.

Florianópolis economy was supported mostly by activities linked to commerce, public services, and tourism. Florianópolis is the state capital of Santa Catarina and public/governmental institutions are highly concentrated there. The local strong commerce attended all suburban city area.

These remain the primary economy activities in Florianópolis. The natural landscapes with white sand beaches and dunes and the green mountains are overlaid with the lines of Azorean culture. The architecture, workmanship, folklore, culinary and religious traditions, coupled with the island-mountain environment has created an important tourist market in Florianópolis.

3 Building and fill methods

Between 1630 and 1890, Boston tripled its physical size by land filling in marshes, mud flats, and gaps between wharves. The leveling and filling required new technologies for transporting, digging, loading and unloading materials, and new ways to support the dams that allowed the drainage of wet areas.

George Goss and Norman Munson quickly became the most renowned contractors for this work. They were New England natives had been railroad contractors in the Middle-Atlantic states. They also won the contracts to fill new land for the State and Boston Water Power Company, and couple with the winning of extensive gravel rights in Massachusetts, they expanded their land-filling business in Boston.

On the first waterfronts areas, waste and old household materials were often used for fill. Then, “cutting down the hills to fill the coves” became the favored process – where peaks on originally Shawmut Peninsula were leveled to provide the fill for the early waterfront development. Later, gravel and sand were more often utilized to fill in large areas.

To fill wet areas, it was necessary to drain the land and allow it to dry and compact. Stone sea walls were created, allowing construction in the former wetland (also known in one Boston neighborhood as “The Fens”). Fill material was then dumped inside the walled off area.

The entire building system was complex, as explained by Newman and Holton (2007, p.132), where “piles were driven through the estuary silts and into the underlying blue clay and cut off at the lowest tide level provided that they were more than ten inches in diameter [...] A solid multilayered plank platform was built onto the piles, and the dry stone granite seawall was constructed directly on the wooden platform” according to part A of Figure 8.

“Another style of seawall construction placed the granite blocks forming the seawalls directly onto the underlying piles. Each granite block was placed on a minimum of three piles and arranged in such a way that gaps separating the individual blocks were not continuous longitudinally across the wall” according to part B of Figure 8.

In another cases, dams were built. “Building the dams and sluices was a very large and complex project requiring huge amounts of cut stone, pilings made from large three trunks, and thick wood planking”

(Newman and Holton, 2007,p.31)

Some structures, like Mill Dam and Cross Dam in the Back Bay, were built both to generate energy and to dry out the wetlands for development. “The one-and-a-half-mile-long dam was a huge undertaking, built with two parallel walls of Roxbury conglomerate blocks, six feet thick at the bottom and three feet thick at the top. The walls rested on massive timbers laid directly on the mud and an elaborate cribbing structure of large timbers laid crosswise” (Newman and Holton, 2007, p.29)

Huge timbers laid down on wet land to support the overlaying stone. “Archeologists found evidence of land making in the early 1700s along the shore of the Mill Pond – large criss-crossed timbers to retain fill had been laid down on the bottom of the pond and fill then dumped on top of them. The line of granite stones in the ground marks the line of a double wood bulkhead (wall)” (Seasholes, 2006, p.35; Fig 9).

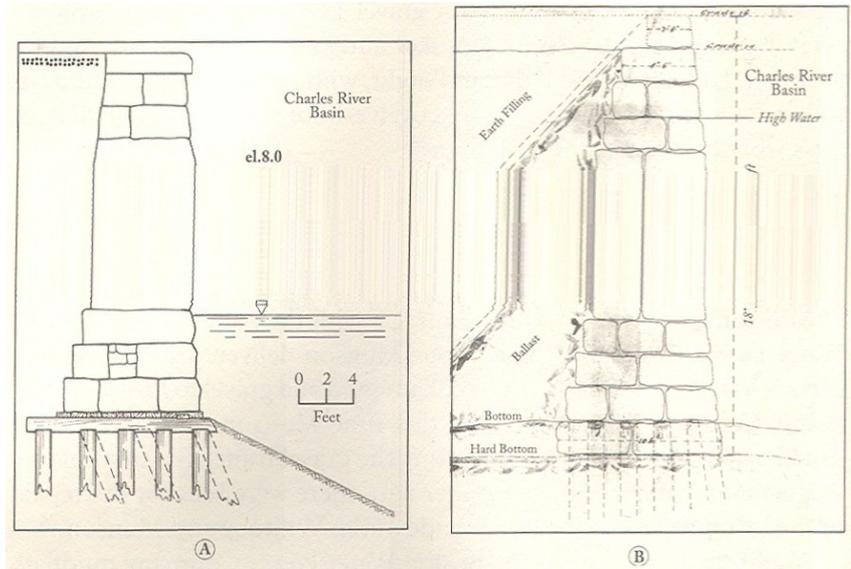


Figure 8 : Early seawall construction methods used in Boston

As development of the new land area ensued, this method was the primary method of drain, build, and fill in order to guarantee a consistent foundation throughout the in-filled areas.

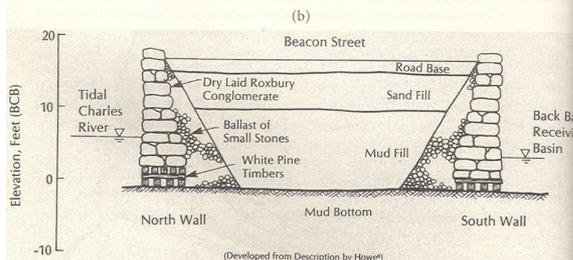


Figure 9 : Dam construction methods used in Boston in the 1800s

Sand originating from south and north bay was the main fill material for the area targeted for expansion in Florianópolis. There, dredging was used to move large amounts deposits along the river bottoms and sea floor. Mechanically, sand was pulled up and then carried by ships to the construction site. Other machines then spread and compacted the fill to ready the site for development.

3.1 Plans and architectcs

When the increase of population linked to trade activities ran into limits to growth at the natural boundaries of the wetlands or ocean bays in both cities, alternatives to permit land expansion – and thus expand commercial, industrial, maritime and residential space – began to be explored by planners, engineers.

In Boston planners put forth many proposals, and in areas like the Back Bay, multiple proposals were often put to the city commissioners. Contemporary Boston’s spatial organizations, and even the names of some areas, are a direct result of the filling of large areas like Back Bay and South Cove.

Robert Fleming Gourlay “in 1844 proposed a grandiose plan that would not only improve the Back Bay but provide for the future expansion of Boston through a network of suburban railway lines that would be carried into the city through subways” (WITHEHILL; KENNEDY 2000 p.146-147)

Gourlay bombarded the Mayor, the citizens of Boston, the Governor and the legislators of Massachusetts with a series of proposals. Among his more famous, he proposed a Circus Island with a central rail intersection surrounded by two rings of houses. From the island, the railroads would drop into a subway system to connect to other terminals.

The Circus Island plan was extensive. “From the Public Garden south along the shore of the Back Bay and along the Cambridge and Charlestown shores of the Charles River, continued to East Boston if required, were to be a band of Boston Boulevards, with a railway line skirting the water, a tree-shaded park two hundred feet wide, and a forty-foot street, along which houses were to be built, with other streets behind”. (WITTHEILL; KENNEDY 2000 p.148-149; Fig 10).

Another Back Bay proposal came from David Sears, with a lake in to center. “Sears [...] came forward in 1849 with a plan for filling the area but leaving a 75-acre oval Silver Lake in the center, to secure the supposed sanitary benefits of fresh air passing over salt water. Boylston Street, in this plan, would lead to the center of eastern shore of the lake, while a new Sears Avenue would run south of it in the region of St James Avenue” (Fig 11).

Charles Bulfinch helped draft an 1808 plan to fill Mill Pond. The committee he served with was charged with the responsibility of choosing the best among many proposals to develop this site. In his plan, Bulfinch imagined a kind of triangle (the Bulfinch Triangle, Figure 12) connecting the original streets to new bridges linking Charlestown, across the Charles River.

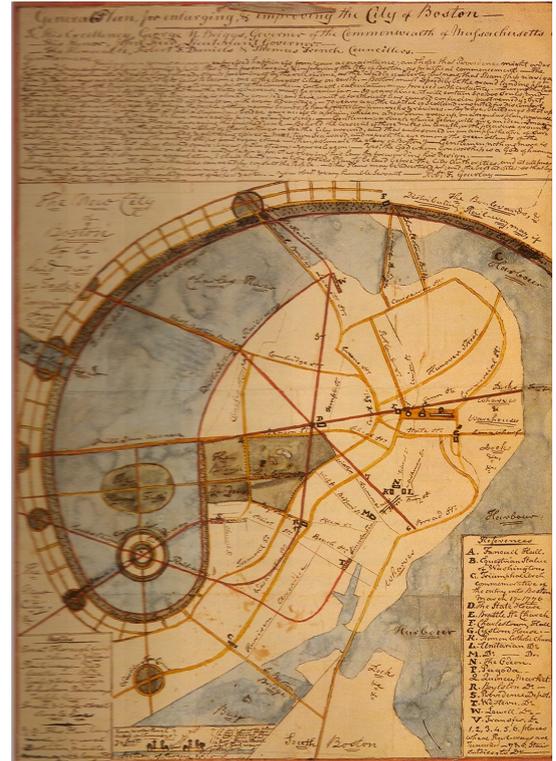


Figure 10 : Gourlay's Back Bay plan

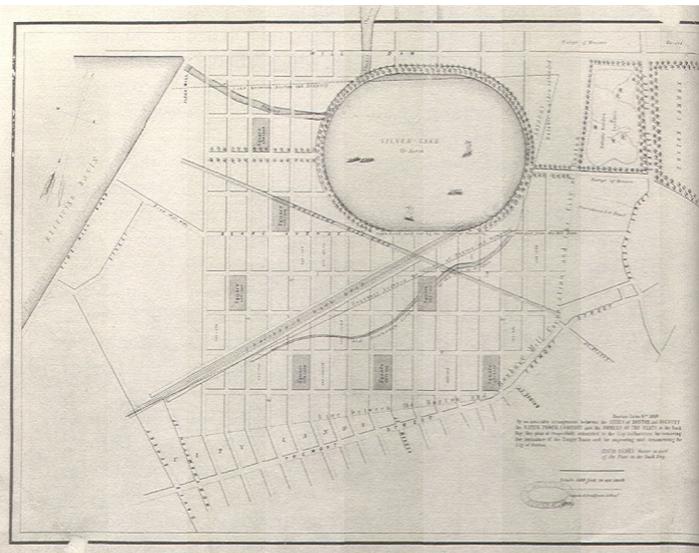


Figure 11 : Sears's Back Bay plan

In Florianópolis, contentious discussion about how the new land would be used forced the city administration to contract with J.C de Figueiredo Ferraz to study the area's land use possibilities. Most agreed that any change needed to be gradual, to preserve the old city. Green areas, parks, commerce zones and automobile access would be needed. City officials were opposed to suggestions that the land should be used mostly for commercial activities, arguing that this would simply be replicating development in Rio de Janeiro that was considered to be a bad example.

The most famous, which was finally accepted, came from Burle Marx. Marx plan concentrated on easy automobile access, with links to the bridges and tied into the existing major avenues. According to Cunha (2005), the original project included some parks and recreational areas.

3.2 Introduction of trains and shovels in Boston

When the landfill activities began in Boston city in the early 1630s, workers used grubbers (a type of ax or hook) and hoes to manually dig out nearby deposits of gravel and sand, then loaded horse-drawn tipcarts to transport the fill material to wharf and pier construction sites.

However, the larger-scale filling of Back Bay, Mill Cove and South Cove surrounding the Shawmut Peninsula (Boston proper of the time) required much vaster amounts of sand and gravel. The solution: level the peninsula's three small hills, the only readily accessible fill.

According to Newman and Holton, (2007,p.79), “By the 1850 the nearest sources of clean sand and gravel for filling the Back Bay lay at least five miles outside Boston in large glacial deposits. This distance made it prohibitive for horse-drawn carts to transport the vast quantities of fill required. The problem was how to excavate and transport large quantities of sand and gravel to the Back Bay quickly and economically”.

Regional weather was yet another problem (NEWMAN; HOLTON, 2007, p.79), “Roads in New England, even toll roads, were muddy quagmires in the spring, rutted and dusty in the summer, and often blocked by snow and ice in the winter”. For too much of the year, moving the amount of fill needed overland by horse cart was nearly impossible.

Two innovations resolved these issues. First, a local inventor, John B. Jervis, improved the English locomotives then used on Massachusetts railroads by adding more wheels and axles, and increasing the engine’s power. The combination allowed for the transport of more weight and volume to be moved in one trainload. Second, William Smith Otis invented the steam shovel.

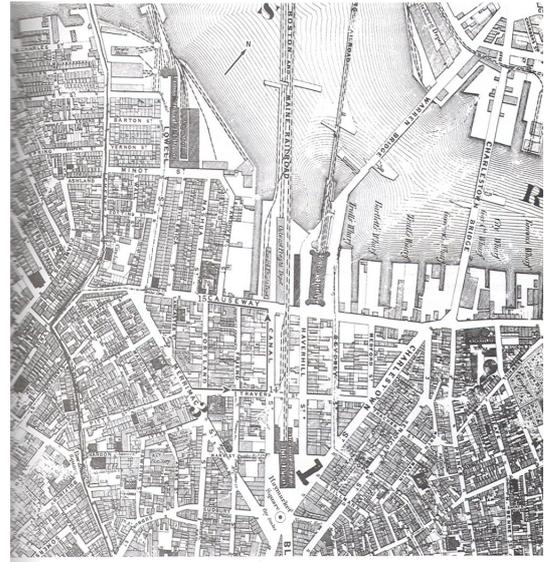


Figure 12 : Boston’s Bulfinch triangle

“[The] Otis invention duplicated the motions of a man with a shovel. It dug up the earth, lifted it vertically in a bucket with a scooping motion, and then swung it in a horizontal arc to either side to deposit its load into a waiting wagon or train car” (NEWMAN; HOLTON, 2007, p.86; Fig 13).

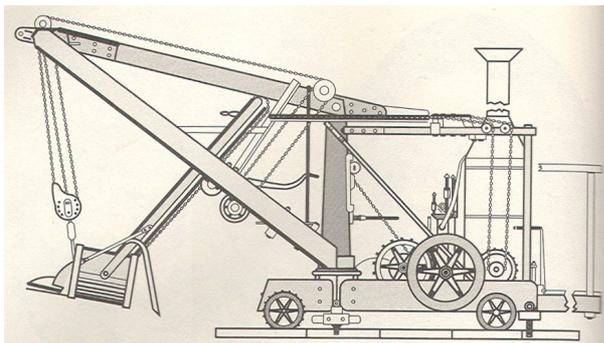


Figure 13 : The Otis steam shovel

New rail lines connected to extensive sand and gravel deposits to the south and west Boston, and, with the steam shovel, earthwork activities increased quickly around 1858.

“The development of more powerful locomotives, side-dumping gravel cars, and steam shovels had solved the problems of excavating and transporting large amounts of high-quality sand and gravel over such long distances” (NEWMAN; HOLTON, 2007,p.95; Fig 14).

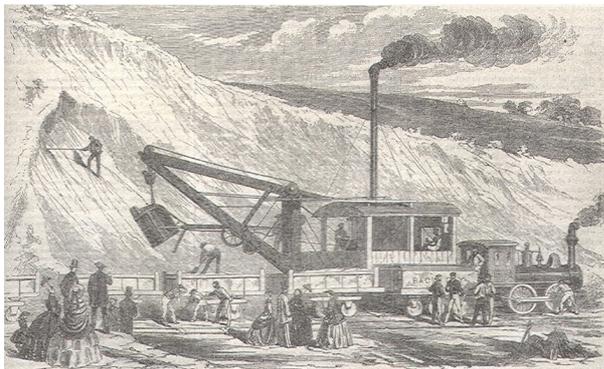


Figure 14 : Improvements in fill exploitation: rail, side-tipping cars, the steam shovel

3.3 Origin of fill materials

Land filling of Central Cove and the harbor zone in the 1630s came from “Tremont” – the three small hills on the peninsula. Only Beacon Hill, the smallest of the three, was not completely leveled – about half of its height was removed for fill.

Accessible sources of fill Boston’s original peninsula were exhausted by these early projects. Future fill would need to be moved eight or more miles from towns like Needham, Canton, Newton and Hyde Park that lie west and south of Boston.

Glacial landforms in the Charles and Neponset River valleys were the best sources, but distance to sites on the peninsula was a barrier until rail transport came

along.

“They [the rivers] carried gravel and sand, which was rapidly deposited where stream velocity decreased. Where the rivers entered ponds on the ice surface, they deposited sand and gravel in deltas that slowly increased in size. Later the ice beneath the gravel melted, leaving behind irregularly shaped sand and

gravel hills on the landscape, called kames” (NEWMAN; HOLTON, 2007, p.9; Fig 15).

Waste material was mixed with the sand and gravel were frequently used for building wharves and piers and filling between docks along the harbor, where, “dense concentrations of artifacts, such as broken dishes and clay smoking pipes, dating from the late 1600s and early 1700s, which suggested that the dock was filled with whole cartloads of trash that were simply dumped into it” (SEASHOLES, 2006, p.6).

In Florianópolis the land fill projects started much later – most in the past 50 years – and thus made use of more modern technology. In particular, a process called “dragagem” in Portuguese was employed, dredging sand from the bay bottoms to be deposited at the shoreline. These bays were ideal sources, not only for available quantity but also lying in calm waters with relatively minor tidal disturbance.

South and North Bay provided the most of the fill sand. Other materials like waste, construction trash and earth removed at other construction sites in the city were mixed into the sand used to enlarge the fill area on Florianópolis waterfront.

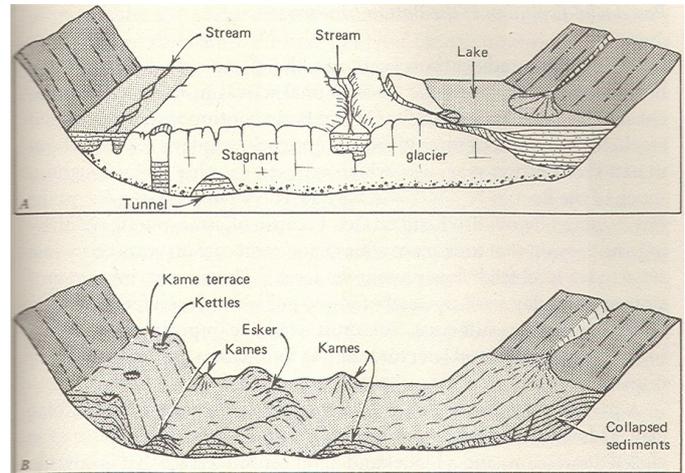


Figure 15 : Glacial origins of major sand and gravel deposits in Massachusetts

Cunha (2005), notes that some material even came from an old cemetery to fill the Prainha area, at which today the State House of Santa Catarina government complex and the Civic Park are built on, and is one of the densest concentrations of employment – and automobile traffic – in the city.

3.4 Public and private incentives

Public and private owners were involved in land expansion projects in Boston. Land owners like David Sears bought smaller lots on mud flats and filled them with gravel and sand, sometimes selling the “new” lots and sometimes using them to exchange for other property.

However, in the significantly larger projects such as the filling of Back Bay, South Bay and Mill Cove, complex works with dams, drainage, and enormous volumes of fill moved over long (in the 1800s) distances required planning and financing at a scale few individuals or companies could then afford. Fortunately, the state, with deeper pockets, was interested in the building and selling new land in Boston.

In Back Bay, public involvement was present but somewhat indirect, fashioned through a “three-way settlement involving the Commonwealth of Massachusetts, the City of Boston and the Boston Water Power Company. This legal document, signed on December 11, 1856, made the filling of Back Bay possible. (NEWMAN; HOLTON, 2007, p.64)

This tripartite contract also established the commission responsible for financing the landfill project. The state did finance the start of the project, in which “the resolve called for making some funds available before any land was sold by allowing the governor to draw up ten thousand dollars from the state treasury to be used by commissioners for the initial filling” (NEWMAN; HOLTON, 2007, p.73).

But the State Legislature removed this funding and the commissioners had to find other funding resources. They accomplished this through a round-about sale of as-yet filled lots. But, in order to pay the contractors who in turn needed to hire workers and buy the machinery needed, the commissioners also gave large grants of land in lieu of direct payment for services. “By these transactions, the commissioners found for further work without expense to the commonwealth” (WITHEHILL; KENNEDY 2000 p.152)

The projects in Florianópolis were built during the Military era. During this period, the government set forth plans to improve services and expand economic activities throughout Brasil, including improved transportation systems and utility infrastructure for industry and trade.

According to Cunha (2005), in the Estado de Santa Catarina, the connection problem problems between Florianópolis and the continent were included in the Plano Catarinense de Desenvolvimento (state-level plan) that was a part of the Plano Nacional de Desenvolvimento (federal-level plan) under Médiçi President governor. The construction of the second bridge in Florianópolis and the waterfront zone was financed by the National government, in part to promote better movement and in part as a symbol of national progress.

At the local level, the state oversaw construction along the waterfront in the early 1970s. Colombo Salles headed the project for filling Baía Sul, which expanded the downtown area by nearly 600.000 square meters.

4 New lands as real state

With the new land, and a need to develop it – in no small part to finance more fill projects – the Boston, commissioners sold lots to the wealthy as one way to bring status to the newly-created neighborhoods and to improve the likelihood of success of the project while generating cash for the state (Newman and Holton, 2007 p.73).

The first sale of new lots on Back Bay involved selling those filled areas that had been given to the contractors. Land the state still owned that had not been presold or granted as payment in-kind could be sold on the open market, but the land held by the contractors had legal problems. Many of them did not wish to become involved in direct real estate sales, but money from state treasury could not be used to finance the effort so another kind of transaction was needed. Additional problems were created by those contractors who were directly selling the lots they controlled and did not want to be in head-to-head competition with the state.

According to Newman and Holton (2007 p.74), the resolution for this problem was sell the lots at the same time, through an auction. *“As land was filled, and as the likelihood of sales appeared to warrant, the commissioners would offer various lots at public auction”* (WITHEHILL; KENNEDY 2000 p.163). In all, twenty four auction sales were held, and about three-fifths of all the State land was sold in this way (Fig 16).

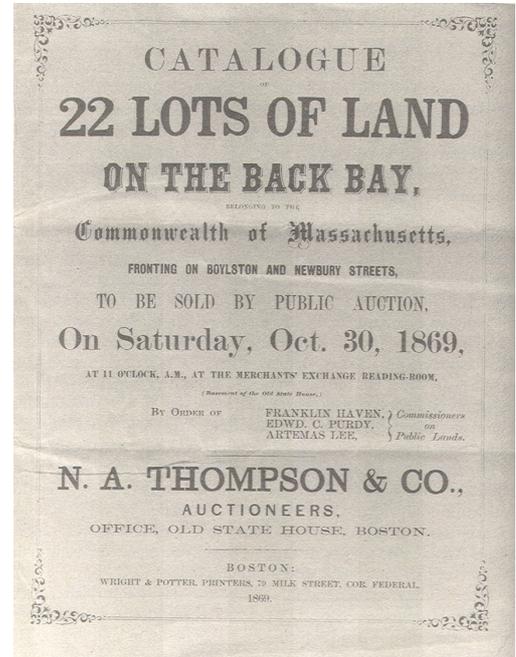


Figure 16 : Advertisement for auction of new lots in Back Bay, 1869

The commissioners also negotiated for large areas of vacant lots in Back Bay to build institutions, not only for the public good but because these in turn made the areas more valuable, which also made them more profitable. These institutions include the Massachusetts Institute of Technology, Harvard Medical School, the Museum of Fine Arts, and numerous churches and public buildings. *“As profits began to be realized from the sale of Back Bay lands, the Legislature generously turned them to good purpose”* (WITHEHILL; KENNEDY 2000 p.155; Fig 17).

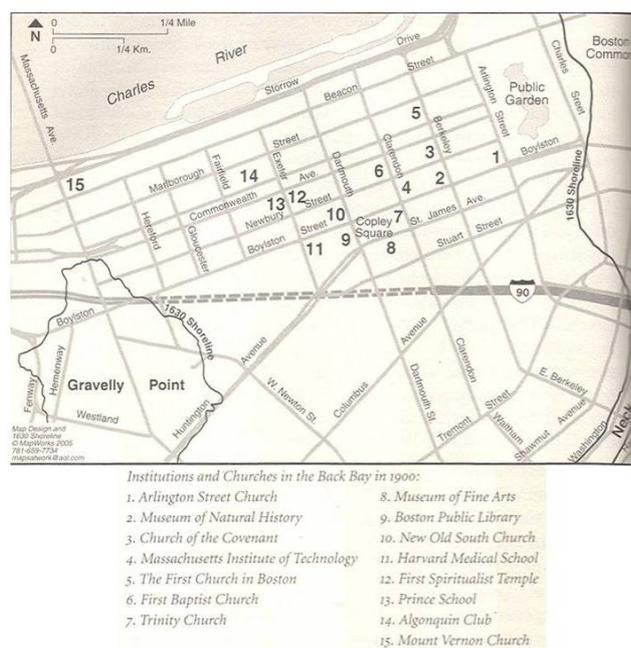


Figure 17 : Back Bay social and cultural institutions

Location, location, location is a widely recognized real estate maxim, but oversupply can depress prices at even the best locations. *“Prices received by the State for Back Bay land varied widely, according to demand and the locations of the blocks being sold. Generally, the average annual sale price for house lots increased over time as the neighborhood became well established”* (NEWMAN; HOLTON, 2007, p77)

Prices in the fill projects varied from \$2.75 per square foot for a prime corner lot to \$1.38 per square foot for side street, mid-block locations (Tab 1). Newman and Holton (2007,p75) found that as a way of keeping the prices high for both profit reasons and in order to make it more likely that the wealthy would be the buyers, sales were strictly regulated by the State Commission, and sales were held at irregular intervals.

FILLED AREAS SOLD IN THE FIRST YEARS				
YEAR	U\$/square foot	TOTAL U\$	TOTAL AREA/ square feet	SELLERS
1857	1.05	70.000	1,5**	state
1858	1.85	101.281	54,832	state
	1.17	305.000	261,632	contractors
1859	2.5	17.430	6,972	state
1860	1.58	N/A*	213,952	auction
	1.91	N/A*	126,701	auction
* Not Available				
** in Acres				

Figure 18 : Boston sales of land in the 1800s

“Between 1857 and 1872, 1,970,739 square feet of land were sold at an average of \$ 2.00 per square foot, and between 1879 and 1886, 346,047 square feet were sold at an average of \$3.28. No land was sold from 1873 to 1878” (NEWMAN; HOLTON, 2007, p.77).

5 Results: benefits and problems

It would be hard to imagine either city without its waterfront district today, even though both are vastly different than they once were. Land filling brought in people, employment, and public, social and cultural institutions, and in a real sense preserved the histories of place even while changing the environs. Daily life is linked to the past.

In the 17th and 18th centuries, the Boston harbor was the key to trade and industry. One-sixth of the city today is located on filled land that sits on or beyond the original waterfront or on former wetlands or marshes – known locally as the fens, and from which the Fenway neighborhood took its name. Comparing the size of Boston today to its origin, much of the central city and many of its institutions, public and private, sit on fill.

Harvard, MIT, Boston University, the Museum of Fine Arts, City hall, Faneuil Hall and Quincy Market either sits on fill or is where they are now because more land became available and more industry and trade could be managed. Transportation infrastructure is also a beneficiary. Logan International Airport connects Boston to the world, the Central Artery Tunnel connects Boston to the national interstate highway system and North and South Stations rail system connect Boston to the region. All of these sit on – or in the tunnel’s case, in – created land.

Back Bay alone is a major contributor to the Boston economy, housing desirable residences, retail, recreation, cultural, tourist, convention and business activities, such as the Prudential Center, Copley Square, the John Hancock Tower, and the Charles River Esplanade (park). Major transportation arteries

here include Commonwealth Avenue and Storow Drive.

Similarly, life in Florianópolis is tied to the fill projects. The new land along the midpoint of the island facing the continent made possible increasing the number of connections with the new bridges. A large part of the fill area here is also dedicated to a wide avenue to connect north and south parts of the city and island to the center and one of the major bus terminals is located here. But the fill zone is not solely paved with roads.

The waterfront on Baía Sul created the potential for a major expansion of the Florianópolis downtown area. There are numerous public institutions, thousands of residential buildings, retail and commercial employment centers, and large parks here.

Cunha (2005) also notes that other public institutions are in the fill zone, such as the less attractive waste treatment station and the socially magnetic Sambódromo, the center of annual Carnival festivities. There is also a convention center and a driving school center. Baía Norte is transected by big avenues creating large lots for large, wealthy residences, hosts expensive vacation places, and the Beira Mar Shopping Center.

These examples illustrate the impact of the filled areas in and around these cities once dependent on the sea and their waterfront districts to sustain their economies and their sense of place. Thousands live, work, eat, shop, play and move through these areas, perhaps without even realizing that they are standing on “new ground.”

5.1 Related problems

Unless, they are among those who own property in the filled areas, and then they may be all too aware of the potential problems.

Since the filling of Back Bay, subsidence has required periodic reconstruction. *“The marshy ground under the Back Bay caused settling of the fill in various places, particularly over the former drainage channels of the tidal mudflat. These areas required extensive remedial work”* (NEWMAN; HOLTON, 2007,p157) Homes in these areas, most of which share a common wall between them or are built one against the other, can experience problems in one home when another’s foundation begins to drop.

“Falling water tables in certain areas threaten the foundations of buildings resting on wooden piles. Corrosive gas from former pollution remains in some places. A severe earthquake near Boston, while not likely, could knock down many older brick and stone buildings on the unstable land of the Back Bay and cause injury and death” (NEWMAN; HOLTON, 2007,p191)

Florianópolis fill areas don’t yet demonstrate these problems, in part because they are not as old and in part because the technology to create the new land was more modern. But some nonetheless question other aspects of change to the city.

Cunha (2005) found that there are tensions related to too much of the new land devoted to automobile use, encircling the historic city center, and some area that have become exclusionary, accessible mostly only to the wealthiest. Behind this are class issues, antagonisms between those who have – money for large houses, the ability to afford a car – and those who do not have those resources. The have-nots would argue that the waterfront was not the success originally planned.

There are also concerns about cultural impacts, as neither the historic center nor the Baía Sul are connected to the sea, Cunha (2005) concludes that the plans for these areas forgot or ignored the cultural importance of the ties between city and sea. Debiasi (2005) also notes the lack of pedestrian access, the over-use of the area for the automobile and the lack of planning for those parts of the fill area that area still empty zone. He notes that these deficiencies are very much related to the urban problems the city is experiencing today.

5.2 Traffic circulation improvements

The landfill activities did bring enormous economic benefits for both cities. The improvements in the transportation systems certainly have allowed and encouraged the expansion of many other activities.

In Boston, the first benefits included the ability to handle more harbor traffic, and thus, more trade as new wharves and piers were constructed and new warehouses on or behind them – sometimes on new land created as the gaps between the docks were later filled. More land also gave Boston the room to build major roads, interstate highways and railroads. The level of manufacturing, commercial, financial and other business activities that are in Boston and its suburbs today may not have been possible if the center itself could not have expanded over the years. It is highly unlikely that Boston would be a global city if the city

had been limited to only that land it began on the small Shawmut Peninsula with its narrow neck connecting it to the hinterlands.

The connections between the continental portion and the island portion of Florianópolis are likewise dependent on the filled part of the city. The two newer bridges, the Colombo Salles and the Pedro Ivo Campos, have their island-side bases anchored in the fill zones. Without the fill, it is impossible to say that those bridges would not have been built, but their construction certainly would have taken longer and been much more costly, either of which could have delayed or dampened the expansion of the city's economy.

The large avenues connecting the bridges to the island road system are on fill, and those avenues not only connect into the center but ring the island. The Baía Norte fill expands and links the north portion of the city to the downtown and to the north bridge. The Via Expressa Sul connects the Hercílio Luz International Airport and the south end of the island. Together, they link the center, the ends, the three major transportation systems (car, bus and air), and create – for better or for worse – a way to tie together business, culture, home and education (as well as the primary and secondary schools, there are two major universities on the island).

And Boston and Florianópolis share another common trait of places that have become overly dependent on the automobile. Debiasi (2005) found that the new bridges and the main avenues linking them are showing increasing levels of congestion in Florianópolis. In Boston, rush hour traffic is almost nationally renowned, and the city is among one of the most congested in the country.

6 Conclusions and future research

Research at the Massachusetts Institute of Technology and Harvard University provide a trove of information about the history of land filling activities in Boston. Land fill activities in Florianópolis are less sufficiently documented. Even that the major universities (Universidade Federal de Santa Catarina and Universidade do Estado de Santa Catarina) that offer Geography and Civil Engineering programs, there has been little study focused on the development of the fill zones. Even the Instituto de Planejamento Urbano de Florianópolis (the city planning agency), responsible for Florianópolis urban plan, has little information available and has not current program to research the uses and effects of the fill development.

In Boston, the initial purpose for filling was improving trade directly connected to the city's ties to the sea. More recently, there has been an increasing focus on the development of residential property and retail activity – to go along with the long-standing technology and finance efforts in business and industry – to draw people back into the city, keep them there, and use them as further ammunition in economic planning and recruiting. Though the Boston fill is older, and the city's economy is less tied to the harbor than it once was, comparing and understanding the history of the fills projects provides a comparison of how these types of projects can have similar underlying motives for undertaking them and end up with diverging outcomes due to political influence or expediency, or, perhaps, a lack of a good plan at the start.

In Florianópolis, the main purpose of the land filling – at least to date – seems to have been focused more on expanding the traffic capacity of the city and only haphazardly about any real planned social and economic development. The Florianópolis case needs to have more attention, to find and archive information about the fill projects, to provide detail on these projects and understand not only how and why the fill was initiated but also to understand what plans were made and how they changed and what might be done in the future.

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