

## URBAN DESIGN

# Working With the Lay of the Land

By René Davids

The built environment is an expression of culture in material form, and the land upon which cities are built is a dynamic surface manipulated to enrich urban culture with varying degrees of success. Throughout the history of human settlement in Latin America, topography and the ecological conditions produced and affected by it have both inspired significant environmental ingenuity and aggravated the region's unique social, economic, and political struggles. The examples of Bogotá, Medellín, Caracas, Mendoza, Rio de Janeiro, and Mexico City, among many others, demonstrate how topographical settings, which have supported richly diverse patterns of settlement since pre-Hispanic times or newer cities like Valparaíso, continue to strongly influence their urban fabric and infrastructure.

While all continents feature mountain chains, the particular configuration of the southern half of the American Cordillera — an almost-continuous sequence of mountain ranges on the western portions of North America, Central America, South America, and Antarctica — as well as the existence of mostly temperate and subtropical climates at higher elevations, provide water sources and cooler temperatures at tropical latitudes.

Almost two-thirds of Mexico consists of plateaus and high mountain ranges, which continue through Central America to form a nearly unbroken sequence with the Andes along the west coast of South America. These mountains connect with the large landmass of the Guiana Shield and extensive Brazilian highlands along the east coast of South America to form a huge rim around the relatively flat continental interior.

Interspersed among the coastal mountains and foothills west of the Andes and lower interior ranges to the east are vast high-elevation plateaus of which the Bolivian *altiplano* is the best-known example. The South American perimeter, consisting of the Andean highlands to the west and the Brazilian highlands along the Atlantic, has a cooling effect on otherwise torrid equatorial climates and divides the region into interdependent terrestrial geosystems and hydrological networks, which together with the rich soils from the erosion of the Andes influenced

regional settlement patterns of the continent's most advanced pre-Hispanic civilizations: the Inca Empire and its immediate predecessors.

Contrary to prevailing myth, the Americas were heavily populated prior to the arrival of Europeans, and indigenous exploitation of terrain, vegetation, and wildlife had produced significant erosion, as well as an astonishing variety of earthworks, roads, and settlements dispersed in a relatively dense pattern of farmsteads, villages, and larger cities. Earthworks were built for religious purposes but also as manipulations of the land to form terraces or elevated platforms for farming and irrigation that were often also necessary because of the indigenous population's frequent preference for the rugged terrain of the higher elevations, which featured cooler temperatures and were easier to defend. According to geographer William Denevan, there may have been as many as several hundred thousand pre-Hispanic artificial mounds constructed of adobe or stone throughout the Americas in different shapes and sizes for effigies, burials, temples, and habitation. Many of these mounds had been long abandoned by the time the Spaniards arrived in 1492, but they remained conspicuous landscape features (Denevan, 1992).

The Europeans were astonished by large flourishing indigenous cities, such as Tenochtitlan, Quito, and Cuzco, most with more than 50,000 inhabitants, as well as extensive ruins of older, abandoned cities, such as Cahokia, Teotihuacan, Tikal, Chan Chan, and Tiwanaku. Less impressive, or perhaps less surprising, were the numerous small villages with a few hundred or a few thousand people, hamlets made up of several families, and dispersed, solitary farmsteads.

Pre-Hispanic peoples developed sophisticated systems of irrigation canals, agricultural terraces, and other elaborate earthworks. They built large raised fields and platforms to improve agricultural output. Deserts and arid mountainsides produced abundant crops that included hundreds of varieties of tubers, roots, and nutritious grains like quinoa and corn. Improved roads, often paved with stone, were constructed over great distances. The Inca road network extending from southern Colombia to central Chile is estimated by archeologist John Hyslop to have measured about 40,000 kilometers or 25,000 miles (Hyslop, 1984).

Many existing settlements were destroyed or built over by the Europeans, causing such devastation and disease

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Detail of Diego Rivera's mural of Aztec city life at Mexico's Palacio Nacional.



Photo by kg88/Wikimedia.



Terraces in Pisac, Peru, turned mountainsides into arable land.  
(Photo by MudflapDC.)



The urban sprawl of Mexico City (above) replaced the well-watered land that still supports *chinampas* (floating gardens) in Xochimilco, less than 15 miles away.

Above: Mexico City.  
(Photo by Kasper Christensen.)

Left: Agriculture in the chinampas of Xochimilco.  
(Photo by Pablo Leautaud.)

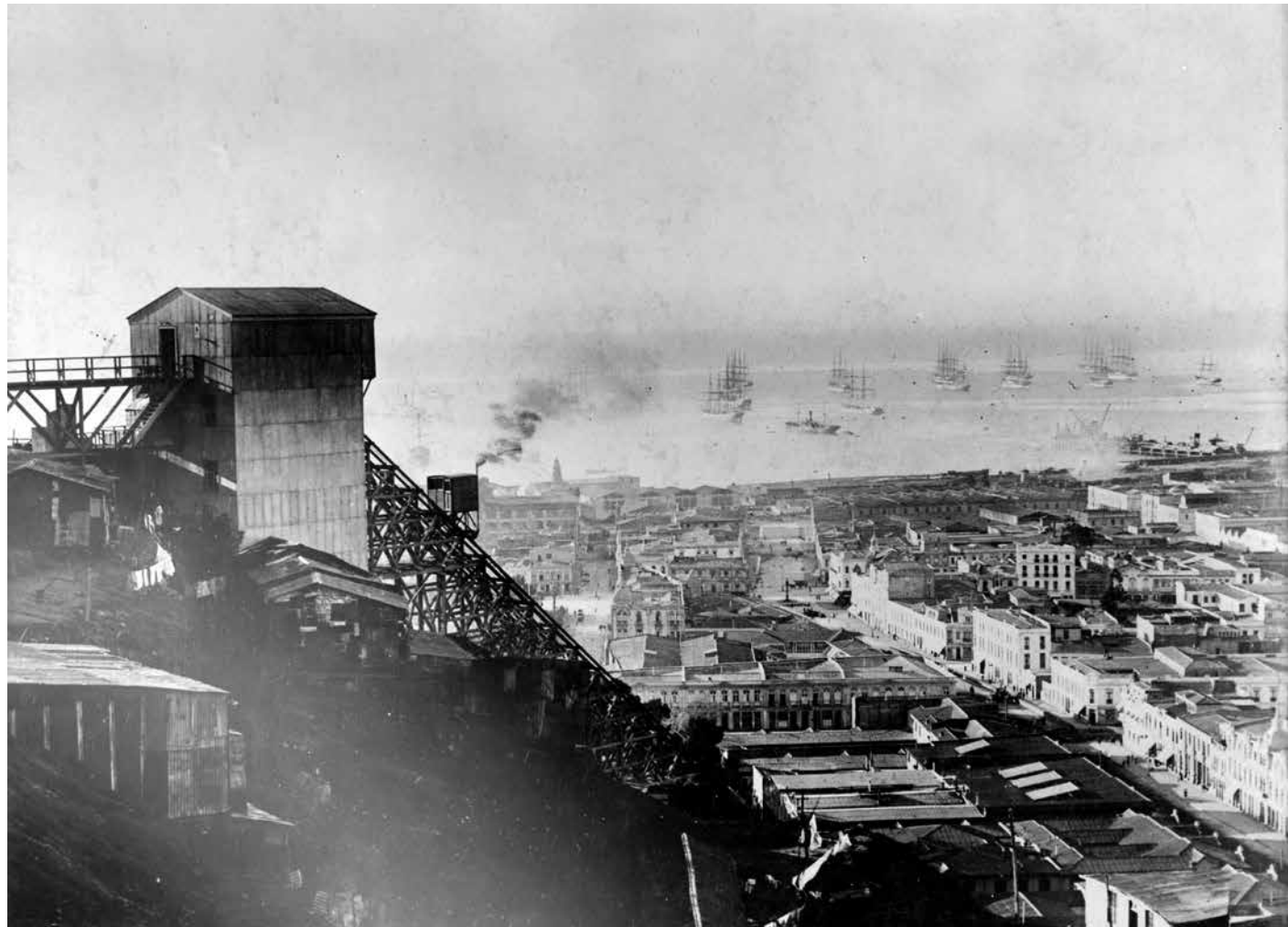


Photo from the Library of Congress.

A steam-powered *ascensor* in Valparaíso circa 1916.

that by 1650, the indigenous population of the Western Hemisphere had been reduced by about 90 percent (Denevan, 1992). Abandoned fields and settlements eventually vanished, and once-cleared forests reclaimed the grasslands. The eyewitness descriptions of wilderness originate from a period 300 years after Europeans first arrived, many of these observations from between 1750 and 1850 when the continental interior was just beginning to be explored, the number of European settlers was not yet significant, and previously decimated settlements had not yet begun to recover.

Although not all pre-Hispanic settlements featured earthworks or buildings on sloping land, those that survived usually had involved considerable earth moving and terrain modification, but most scholarship has focused on the buildings, while the land on which they were constructed is rarely discussed (Hyslop, 1990). It is therefore not surprising that the impact of regional topography and ecology on the pre-Hispanic built environment has also been mostly ignored, perpetuating the notion that the significant built works that survived had emerged in a few isolated spots, often surrounded

by what was presumed to be untouched, endangered, but still transcendent nature, as the only surviving vestiges of cultures that had vanished long ago. As William Cronon has observed, the wilderness is as much of a human construct as the works themselves, and the same physical conditions that contributed to the much-admired pre-Hispanic architecture continue to inspire formal and technological innovation (Cronon, 1995).

When cities of newly independent Latin American republics began to expand on sites chosen by the Spaniards for their colonial settlements or in new locations, the expanding urban centers confronted rugged terrain that required creative solutions and some improvisational ingenuity to overcome formidable topographic obstacles. At the end of the 19<sup>th</sup> and beginning of the 20<sup>th</sup> centuries, the city of Valparaíso, Chile — settled on a narrow strip of flat land between coastal mountains and the Pacific Ocean — could grow only by conquering the surrounding slopes. This expansion was achieved by installing a series of 30 *ascensores*, or inclined elevators, an innovative means of transportation that allowed residents to travel back and forth from their hillside neighborhoods to the commercial

district on the flat land surrounding the port. In the era when ships navigated around Cape Horn to reach the West Coast of North America, prior to the opening of the Panama Canal in 1914, the *ascensores* were instrumental in Valparaíso's rise to prominence as the most important port on the Pacific coast of South America.

Roughly 125 years after Valparaíso installed its first *ascensor*, the Colombian city of Medellín solved a similar problem of hillside-to-hillside access with the installation of the Metrocable, the world's first gondola lift system dedicated to public transport, linking the informal housing on the slopes of the Aburra Valley to the rest of the city with only minimal disruption of the existing urban fabric. Along with other infrastructural improvements — schools, libraries, public spaces, and bridges — the Metrocable has significantly improved the quality of life in impoverished neighborhoods and helped transform Medellín's reputation from that of a haven for crime to one of the world's most progressive cities. Medellín's success has influenced the initiation of similar projects in other Latin American cities, including Rio de Janeiro and Caracas, where conveyances

similar to the Metrocable were integrated with existing networks of cable cars and stations.

An integral part of Valparaíso's civic identity, as well as an essential component of the transportation network, the *ascensores* eventually became the city's most recognizable feature, and the cable cars in Medellín, Caracas, and Rio have all gathered enthusiastic critical attention, but other infrastructure projects in Latin American cities were instrumental in completely transforming the urban landscape. By far the most dramatic of these was the construction of canals begun in the early 16<sup>th</sup> century, which almost drained the Mexico City basin, fundamentally changing the character of a place once known as "the Venice of the Americas" into a megalopolis of 20 million people with a looming water shortage.

Surrounded by forested mountainsides that channeled abundant precipitation into five lakes, the Valley of Mexico had no natural outlet for the accumulated water, but pre-Hispanic hydrological engineering developed a productive environment for Aztec agriculture, which was subsequently destroyed by the Spanish conquerors.

Medellín's Metrocable links poor hillside communities with the urban center.



Photo by Alan.



Photo courtesy of Instituto Moreira Salles.

The destruction of the Morro de Castelo in Rio de Janeiro.

The *conquistadores* also deforested the surrounding hillsides and filled in Lake Texcoco, site of Tenochtitlan, the Aztec capital. The catastrophic flooding that ensued forced the construction in 1788 of a massive canal that diverted water to rivers flowing to the Gulf of Mexico. In the mid-1850s, the government approved the construction of the Gran Canal. Eventually completed in 1900, this aqueduct successfully drained most of the lakes, but summer flooding continued until a drainage system installed deep underground was finished in 1970. With much of the city now covered in asphalt and denuded of trees, rainwater is prevented from percolating into the ground to replenish the aquifer, which today is almost depleted. At more than 7,000 feet above sea level, Mexico City is forced to pump its water nearly a mile uphill from as far as 125 miles away.

An opposite series of challenges confronted the arid Argentine city of Mendoza, located on the leeward side of a secondary range of the Andes. When the Spaniards founded the city in 1561, Mendoza inherited a system of irrigation canals, built by the indigenous people to make the land arable, that distributed snowmelt water from the Andes flowing into the Mendoza River. After a catastrophic earthquake destroyed Mendoza in 1861, a new city that extended the existing canal network was built near the

ruins of the old colonial settlement. Broad streets, squares, and public parks all lined with trees created an urban oasis with lush canopy of shade. An influx of European immigrants towards the end of the 19<sup>th</sup> century took advantage of the extensive irrigation system to cultivate a variety of crops, plant orchards and vineyards, and establish wineries and food-processing plants as well as a petrochemical industry, making the greater Mendoza area one of Argentina's most economically vibrant regions.

A clear instance of the power of topography and its erasure in order to confirm (or replace) an urban identity occurred in Rio de Janeiro, where an ambitious redevelopment plan was implemented at the beginning of the 20<sup>th</sup> century. Swamps were drained and new streets created, including the Avenida Rio Branco, an important thoroughfare opened in 1912. These and other improvements succeeded in reducing the frequent outbreaks of yellow fever and smallpox that had afflicted the port, but perhaps the most significant and controversial renovation was the hotly contested demolition of the Morro do Castelo — the highly visible hill with dilapidated residential fabric at the edge of Guanabara Bay on which Rio had been founded in 1567 — to extend the shoreline for an international exhibition, allow the tidal flows to penetrate

the interior portions of the city, and remove what many regarded as an unsightly reminder of a colonial past.

Water and topography also provide the primary constraints in Bogotá's effort to develop beyond its natural barriers: the Cerros Orientales to the east and, to the west, the Río Bogotá flowing northeast to southwest across the savannah. By the turn of the 20<sup>th</sup> century, all the trees from the surrounding foothills had been harvested for fuel or building material, leaving barren slopes vulnerable to erosion from runoff, dangerous mudslides, and flooding. These problems were remediated to some extent with the installation of underground piping and reforestation of the hills, but continued expansion to the southwest still threatens the wetlands of the savannah. To limit the need for extensive highway construction in developing areas and reduce further damage to the wetlands, Bogotá has established a nearby network of pedestrian and cycling paths, which is also connected to a system of libraries. While modest in scale and scope, this network represents an imaginative, ambitious effort to protect Bogotá's remaining wetlands and water bodies, while increasing affordable transportation options and

New pedestrian and cycling paths in Bogotá.



Photo by Pedro Felipe Wikimedia.

helping to forge a new identity for a city that as recently as the turn of the century, was infamous as one of the world's crime capitals.

Of the 600 million people in Latin America, 80 percent now live in cities. Some of these cities boast a legacy of pre-Hispanic urbanism, and many include the surviving remnants of the planning, infrastructure, and buildings of a shared colonial past, all of them with the residue of social inequities. With their focus on urban innovation, environmental conservation, and social inclusion, Medellín, Bogotá, and other cities inspired to followed their examples hold out the promise of an improved urban future with opportunities for all citizens, as the barriers between rich and poor gradually disappear.

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References for this article are available online.