

# Environmental Factors Influencing Urban Sustainability Las Vegas, Nevada, & Venice, Italy

*Stephen A. Roosa, CEM, CIAQP, MBA  
Energy Management Alternatives, Inc.*

In many ways, no two cities could be more dissimilar. Las Vegas, Nevada<sup>1</sup> is a North American city. "There is no place like it. It is literally a beacon of civilization... astronauts make out the lights of Las Vegas before anything else."<sup>2</sup> Rapid growth springing from the gambling dollar has created an expanding set of centrally located service industries. Built on a fragile desert plain, the city was a product of the automobile and the availability of a fresh water source when the Colorado River was dammed. Venice, Italy, a European city like no other, often jettisoned its industries to nearby islands in the lagoons, or more recently, to mainland areas such as the town of Mestre to accommodate her growth.<sup>3</sup>

Goethe once said of Venice, "water was at once street, square and promenade. The Venetian was forced to become a new creature; and Venice can only be compared to



itself."<sup>4</sup> Venice fights to hold back the tides, at times literally inundated with water. Las Vegas suffers from never seeming to have enough water.

Commonalities are difficult to find and it is there that the difficulty of comparing and contrasting these two cities begins. Each has a distinctive style observed in the collage of their streets, buildings

and people, which contributes to the aggregate urban form. Christian Norberg-Schultz observed, “we have over and over again shown that a form only has meaning within a system of forms, and that the idea of independent meaningful forms is a misconception.”<sup>5</sup> Las Vegas and Venice each represent an alternative physical form for urban development.

The central issue of this article deals with urban sustainability and its environmental impact. The primary thesis is that these cities, though quite different in many ways, each will have environmental concerns which impact urban development. In addition to environmental issues common to most cities (e.g. sewage disposal) the focus will be on the environmental concerns which impact urban growth and sustainability. This article has the following goals:

- Provide a descriptive comparison of two cities. This comparison will briefly consider certain structural and physical aspects of both cities with a focus on their urban development. The population growth and key environmental issues which apply to each city will be used as a gauge of sustainable attributes. Aspects of each city which might be considered sustainable or non-sustainable will be considered.
- Discuss specific environmental and energy related concerns which apply to each city. How have the environmental concerns affected urban development and limited growth? How have these issues been addressed? Have development decisions been made that address environmental issues and avoid environmental problems? Finally, conclusions will be drawn as to how the future development of each city may be affected by the environmental factors discussed.

## URBAN SUSTAINABILITY

Urban sustainability is a phrase that evokes varying meanings. Urban sustainability tends to refer to a somewhat idealized model of urban development which attempts to address a wide set of concerns about urban growth, patterns of urban development, and issues that arise as urban development occurs. The four principles of urban

sustainability in the European Community's (EC) Sustainable Cities Agenda<sup>6</sup> include:

- *The principle of urban management*—a process that requires planning and impacts the governing of urban areas. The process of sustainable urban management requires tools that address environmental, social, and economic concerns.
- *The principle of policy integration*—implements means to stimulate the synergetic effects of social, environmental, and economic dimensions of sustainability.
- *The principle of ecosystems thinking*—emphasizes the city as a complex system incorporating aspects such as energy, natural resources, and waste production.
- *The principle of cooperation and partnership*—considers the crucial import of interactions among various levels of government, organizations, and interest groups.

Beatley notes that the European Union (EU) Green Paper advocates integrated approaches and argues for an ecosystems view of cities.<sup>7</sup> He observes that cities affect their local environments (e.g. regional hydrologic systems) and are in fact habitats for plants and animals. The EC suggests that cities must be viewed as a complex “interconnected and dynamic systems. Cities are both a threat to the natural environment and an important resource in their own right. The challenge of urban sustainability is to solve both the problems experienced within the cities themselves... and the problems caused by cities.”<sup>8</sup>

The components of urban sustainability according to Drakakis-Smith include: 1) equity, social justice, and human rights; 2) basic human needs, such as shelter and health care; 3) social and ethnic self-determination; 4) environmental awareness and integrity; 5) awareness of linkages across both space and time; and 6) not seeking gain at the expense of someone elsewhere in the world or of the generations to come.<sup>9</sup>

It is apparent that the issue of urban sustainability is broad and involves a range of issues. For the purposes of this article, sustainable development is defined as: The ability of physical urban development

and urban environmental impacts to sustain long-term inhabitation by human and other indigenous species while providing: 1) an opportunity for environmentally safe physical development; 2) efficient use of natural resources; 3) a framework which allows improvement of the human condition; and 4) manageable urban growth. Non-sustainable urban development is the antithesis of sustainable urban development. Non-sustainable development implies growth which is environmentally unsafe, consumes resources inefficiently, degrades the human condition, and is characterized by persistently unmanageable development.

## COMPARING LAS VEGAS TO VENICE

The people of Las Vegas settled the Las Vegas Valley for many reasons. These included the dry climate, inexpensive land, low taxes and legalized gambling. The early settlers of Venice arrived in the 5th century in fearful flight from Attila the Hun and other invaders. Las Vegas is a 20th century new town and boom town. It is perhaps the fastest growing city in the U.S. Venice is over 1,000 years old and has been losing population in its central core. Vegas grew from the sands of a desert landscape of sagebrush and cactus. Venice rose from 117 islands spread across brackish estuary. Las Vegas is land-locked and has known only democracy. Venice is a port city and has known several forms of government including its own independence as a city-state controlling a region called Veneto. Las Vegas grows outward and upward with only a brief history to preserve. Venice faces a costly struggle to preserve its architecture and upgrade its outdated infrastructure. The city plan of Las Vegas is a set of paved intersecting grids. The city plan of Venice is a maze of narrow pedestrian streets and canals. Las Vegas seems to be a city of fences and parking lots. Venice seems to be a city of walls and water. Transportation in and around Las Vegas is by automobile and tourist buses. Transportation in and around Venice is by boat and vaporetto (a gas-powered boat for bus-sized loads).<sup>10</sup> The main street in Las Vegas is a linear and paved six-lane roadway, nicknamed the "Las Vegas Strip" and surrounded by massive theme hotels and casinos. It is crossed at right angles by innumerable intersecting roadways controlled by traffic signals. The main street in Venice is an "S" shaped waterway (3

kilometers long) named the "Canale Grande" which is surrounded by residences, palaces, boarding houses, and wharves. It is crossed in only three locations by pedestrian bridges which separate walkways from waterways. If you would like to cross the canal elsewhere, you must ferry across by boat. While Las Vegas is a city that never sleeps, Venice draws down its metal shop doors in the afternoon for a peaceful siesta.

Las Vegas's gambling palaces are constructed on fields of sand and scrub. Its buildings tend to imitate. One structure recreates a New York skyline, another recreates Camelot, yet another ancient Egypt. There is a copy of the Eiffel Tower, a Roman palace, an Alpine hotel, a reproduction of the Statue of Liberty and a miniature Empire State Building. There is a shopping galleria which recreates a Venetian canal and a Venetian streetscape. "Off a sham Piazza San Marco, gondolas glide on simulated Venetian canals carved onto the face of the Great American Desert."<sup>11</sup> There are more guestrooms in Las Vegas than anywhere in the U.S., twice as many as New York.<sup>12</sup> Las Vegas Mayor Oscar Goodman, recognizing who pays the taxes, recently said, "We must be prudent on our approach, assuring the preservation of the good name of Las Vegas... which represents honesty, integrity and a fair shake for the gambler."<sup>13</sup>

Hank Savitch calls Venice "Ah, the museum city."<sup>14</sup> Venice is an original; it has no counterpart. It is among the quintessential pedestrian cities. It is a world asset. The architect La Corbusier commented, "a functional city, Venice, extraordinarily functional."

So why compare these seemingly incomparable cities? It almost seems a challenge to find commonalities. The people of both cities display several common behavioral similarities. Citizens of both cities seem to be accepting of everyone, display remarkable hospitality, and open their doors to all comers, local and international. Both cities are major tourist attractions in their own right. An interesting behavioral similarity in the development of both cities includes the widespread cultural approval of risk taking and gambling.<sup>15</sup> The hospitality industry is critical to both cities. Venice is filled with quaint hotels and pensiones. Las Vegas offers nine of the ten largest hotels in the world.

What can be learned from the history of Venice that could apply to the future of Las Vegas? Is Las Vegas destined to become a sort of museum in its own right? Is there anything in Las Vegas that will survive the next 100 years? And what of Venice? Will the seas rise

and flood her stone streets permanently? Or will a sea wall be constructed to protect her, with tourists simply paying day admission to the museum?

## LAS VEGAS BACKGROUND

Nevada was part of the Utah territory prior to statehood in 1864.<sup>16</sup> Clark County, the home of the future Las Vegas, was appended to the state of Nevada in 1867. Completion of a railhead in 1906 spawned the incorporation in 1911 of the City of Las Vegas, which today encompasses 121 square miles. The San Pedro, Los Angeles, and Salt River Railroad intersected the Las Vegas and Tomopah Railroad which linked the city to Virginia City. A gold deposit was located south of the town and a mining camp developed at Searchlight from 1892-1907.<sup>17</sup> The city benefited from its dry climate, a nearby fresh water source (Colorado River), the construction of Boulder Dam (beginning in 1931), and creation of Lake Mead. Businesses developed due to the opportunity for quick marriages, easy divorces, gaming and prize fights, inexpensive land, and the completion of Interstate 15 (connecting Salt Lake City to San Bernardino).

The ever-present and moderating influence of the Mormon Church combined with the likes of Benjamin Siegl and initial gangster control of casinos created an unusual set of influences in the city. It has managed to maintain its standing as a tax haven. Legalized gaming, the proliferation of the automobile, and a new convention center have allowed Las Vegas to specialize in developing an entertainment-based, service-oriented industry base. The city has recently developed theme park-like facilities (e.g. MGM Grand Adventure), with roller coasters, water parks, and various other attractions (e.g. StarTrek Adventure at the Hilton). Initially an adult gambling haven, these attractions have generated additional commercialization and employment by offering entertainment activities for the entire family.

Since gambling is not legal in either California or Arizona, and Reno is 400 miles to the north, the Las Vegas metro area almost has a regional monopoly on gambling and has become the premier location in North America. More than 50 million people journey to it each year.<sup>18</sup> Central place theory would consider that such factors allowed the presence of an economy of scale which allowed trade and specialization to

occur. For Las Vegas, the range of its primary good (gambling) has expanded well beyond its immediate region with development of its international airport. This has contributed to the city's explosive growth in the last 30 years.

To attract high rollers, Las Vegas casinos offer perceived greater benefits for their customer's gambling dollar and, as a result, many are willing to travel from international locations. In addition, large stakes gamblers may be provided with transportation, better accommodations, and other incentives for coming to Las Vegas casinos.

Within Las Vegas, there is competition between the downtown area, the Las Vegas Strip (Las Vegas Boulevard South), and off-strip locations (e.g. the Hilton and Las Vegas Convention Center). Local residents are often influenced by advertising, dining, dinner shows, or special offers in selecting a location to gamble. Due to the large number of casinos, this creates a highly competitive local market and provides a variety of entertainment options for customer.

The transformation of Las Vegas was caused by a loosely organized growth coalition that promoted Las Vegas as a place that was profitable for businesses and a tax haven for residents.<sup>19</sup> Nevada lacks corporate, income, inheritance, state, gift, franchise, or inventory taxes. In addition, it is a right-to-work state and has a large pool of low wage labor.<sup>20</sup>

Also fostering growth are other structural facilitators. There was an abundance of inexpensive flat land in the Las Vegas Valley over which a grid of streets was easily laid. The soil was easily dug for foundations and sand was readily available for concrete construction. Interstate highway access to Los Angeles and the development of an international airport provides additional transportation infrastructure which further fosters growth.

## VENICE, ITALY—BACKGROUND

Venice was born on a collection of over 100 islands in a protected lagoon fed by several fresh water rivers, including the Benda, the Sile, and the Piave. The early Venetians were a community of boatman. After 1000 A.D., they become a seagoing nation, sailing and trading in many parts of the Mediterranean.<sup>21</sup> Apart from slaves, the primary cargo was lumber, which provided raw material for ship building. The Mediterra-

nean as a whole suffered from deforestation and the Venetians, at the head of the Adriatic, tapped one of the few remaining areas in Europe where quality timber was plentiful. Since quality timber was considered a strategic defense material, the pope and the emperor periodically forbade its sale.<sup>22</sup> Regardless, the Venetians often placed business interests before either ecclesiastical or imperial edict. It was the superior supplies of lumber which initially formed the basis for a division of labor between the people of the lagoons and distant Mediterranean peoples from whom to purchase wine, wheat, and oil.<sup>23</sup> Other natural resources in the immediate environment were critical to the early growth of Venice. Salt and fish, both plentiful in the lagoons, were also key trade goods.

Structural conditions which affected Venice included the need that transportation be by foot, wagon, or boat. The shallow lagoon provided islands for construction, but when built out, growth had be accommodated by creating more land. This was accomplished by filling in shallow lagoon areas or by shifting the growth to other outlying islands within the lagoon. That the city rests on millions of wooden stilts pounded into marshy ground is well known.<sup>24</sup> Over the ages, people living in the lagoons have had to haul in countless tons of dirt, silt, wood, and stone to fortify their swampy islands and keep their homes and cities from disappearing into the sea.<sup>25</sup>

## LAS VEGAS POPULATION

The growth of Las Vegas since 1940 has been phenomenal by almost any standard. People who came from other places inhabit the town. The city of Las Vegas had a population of only 8,422 in 1940, growing to 24,624 in 1950.<sup>26</sup> This growth was spurred by construction and operation of a nearby magnesium plant which operated during World War II. Las Vegas officially became the largest city in Nevada in 1960, with a population of 64,405.<sup>27</sup> Two important technological changes were also facilitating growth. One resident stated that, "The most important developments in Las Vegas history was the Carrier Air Conditioning Company's ability to air condition large spaces, combined with direct flights from Los Angeles."<sup>28</sup> With temperatures on summer days reaching 105 to 110 degrees (40 to 43 degrees C), the value of air conditioning cannot be understated. Despite the dry climate, year-round



occupancy in the Las Vegas Valley is difficult without air conditioning.

The Las Vegas metropolitan area includes all of Clark County, Nevada. Primary incorporated areas include Las Vegas, North Las Vegas, Henderson, Nellis, Boulder City, and others. By some measures Las Vegas, Nevada, is the fastest growing city in the U.S. Color-enhanced Landsat 7 imaging shows development in a 50 by 50 square mile (80 by 80 square km) section of the Las Vegas Valley. Heat generation is one indicator of changes in urban activity. The increased geographical impact is telling. Census data indicates that the population increased from 273,000 to 863,000 from 1972 to 1992. The year 2000 census posts the Clark County metro population at 1,375,765. The most rapidly growing population segments from 1990 to 2000 were the under 5 and over 75 age groups, suggesting the possibility that families were locating in Las Vegas and that the elderly were staying.

Despite being born as a gambling mecca, the city has spawned significant construction and service sector growth. The service sector is the dominate base industry and it accounted for 56 percent of employment in 1993 and 60 percent in 1999. The growth in the service sector is due in part to the construction of large hotel and casino complexes and amusement facilities on the Las Vegas strip in the downtown area. This centralization of the "entertainment" district impacts infrastructure development by placing demands on water, sewer, and utility systems. In addition, support services for the expanding population have added to service sector demand. Population data tends to indicate a recent decentralization of population to the suburbs, leaving the central areas to support commercialization and the tourist industry. Primary employment centers are located either downtown, at government locations or on the Las Vegas strip. This provides evidence of a growing spatial mismatch due to the continued expansion of and movement of the residential population to the suburbs.

## VENICE, ITALY—POPULATION

By 1200, the population of Venice had reached 80,000, growing to 120,000 a century later with 160,000 in the lagoon area as a whole.<sup>29</sup> In 1330, the population of Paris approached only 100,000 and Venice was among the largest cities in Europe.<sup>30</sup> Due to a series of plagues, the population dropped for a period, increasing to 120,000 in 1500 and

190,000 in 1570.<sup>31</sup> Structural factors which contributed to limits on population included: 1) the difficulty of building land from pilings, dirt, ballast and debris; and 2) the significant costs of multistory buildings of stone construction.

During the 17th and 18th centuries, the population fluctuated between 100,000 and 160,000, dropping to 120,000 in the historical center by 1969.<sup>32</sup> It is interesting that the population over a 750-year period fluctuated within a relatively narrow range. Today, the total population of a newly defined Venice has grown to 367,800.<sup>33</sup> This includes the industrial mainland suburbs of Mestre and Porto Marghera.<sup>34</sup>

## LAS VEGAS ENVIRONMENTAL ISSUES

Las Vegas is cradled in a corner of the Mojave Desert, with a correspondingly dry climate. The area receives between 0-8 inches (0-20 cm) of rain annually and has a 239-day growing season. Las Vegas was generally blessed with clear and generally pure air.<sup>35</sup> The key environmental concerns have been availability and access to water supplies and nuclear fallout. As early as 1972, the Las Vegas basin also began to experience air pollution during parts of the year.<sup>36</sup>

Water from the beginning was scarce everywhere in Nevada. The gushing springs located at the site of what was to become Las Vegas were described by mapmaker John Fremont 1844.<sup>37</sup> Nevada's surveyor general reported in 1865 that, "millions of acres of land in this state now completely worthless, would be valuable if irrigated."<sup>38</sup> In addition to three major springs in the area, water was initially provided by wells which tapped prehistoric pools underneath the desert. Wells typically needed to be drilled to a depth of only 300 feet (91 meters).<sup>39</sup> The water made the site a relay point for railroad traffic. The Colorado River Compact in 1922 promised Nevada 300,000 acre feet per year of the flow of the Colorado River.<sup>40,41</sup> Las Vegas grew after the construction of Boulder Dam in 1931 (just 30 miles away, it has been renamed Hoover Dam) which choked the Colorado River, created Lake Meade, and created a source for both fresh water and electricity. In the early 1950s, wells pumped around the clock to provide green islands, palm trees, and pools for the new casinos with the desert beginning again just beyond their fence lines. The town, then and now, has to be ceaselessly irrigated. With water a

scarce commodity, by the mid 1950s sewage effluent was being used to keep golf courses green.<sup>42</sup> In 1956, district engineers called the circumstances “an impending crisis in the water supply situation” and started to pump a supplemental flow of water 1,000 feet up and 25 miles out from Lake Mead.<sup>43</sup>

By the 1970s, future serious water shortages were being predicted. Solutions included developing new sources of water other than additional artesian wells or increasing allotments from Lake Mead. Ambitious schemes that were being considered included: 1) piping water from outlying areas within 100 miles of Las Vegas; 2) a 1,000 mile aqueduct from the Columbia River in the Pacific Northwest; and 3) desalinization of water and a pipeline from the Pacific Ocean.<sup>44</sup> A proposal to import water from deep holes in the Amargosa Desert north of Las Vegas ran into an environmental roadblock with the discovery of one of the oldest forms of life, the pupfish, which inhabited the subterranean water.<sup>45</sup>

A major boost to the Las Vegas economy came in the mid 1960s with the Southern Nevada Water Project, which tapped the balance of the Colorado River water promised in 1922. Construction of a four-mile tunnel through the mountains from the Colorado River to the Las Vegas Valley was completed in only four months. By 1982, over a quarter of a billion dollars had been invested in the water system and Clark County had one of the most modern and effective water distribution systems in the county.<sup>46</sup> In 1989, the Las Vegas Valley Water District proposed a \$1.5 billion project to drill 140 new wells to tap new underground water sources in adjacent counties along with 1,000 miles of new pipeline to transport the water to the Las Vegas Valley.<sup>47</sup> Property owners and rural governments effectively opposed the proposal, as it may have depleted surface and underground water supplies for their towns and farms.

Despite all efforts, toward the end of the 20th century, Las Vegas has a “depleted and polluted water supply.”<sup>48</sup> In areas of town, the basin has sunk as much as five feet, cracking and splitting foundations.<sup>49</sup> Las Vegasans currently use more water than residents of any other major city in the world, 325 gallons per capita per day.<sup>50</sup> This is an improvement from the 360 gallons per capita per day consumed in 1989.<sup>51</sup> Considering the future availability of water for Las Vegas, the cited prediction is that “available sources of water (underground or Colorado River) will run up against the population wall around the

year 2005.”<sup>52</sup> The interesting assurance from the Southern Nevada Water District is that water will always go to the highest bidder, and that Las Vegas will always be wealthy enough to cut deals with farmers, ranchers, western states, and the government to get all the water they will need.<sup>53</sup> A series of interim measures will likely provide water for continued growth through 2025, when the population is projected to reach 2.3 million.<sup>54</sup>

Treated sewage discharges from the Las Vegas metropolitan area approach 68 to 69 million gallons per day.<sup>55</sup> All goes into Lake Mead at Las Vegas Bay, causing a plume of pollution consisting of potentially toxic blue-green algae which thrives on nutrients found in the sewage. Discharges include ammonia, phosphates, and nitrates.<sup>56</sup> Chemical and bacterial residues cannot be filtered by conventional water treatment. Interestingly, the Las Vegas drinking water supply is drawn just six and a half miles downstream of the location where its treated sewage is discharged into Lake Mead.<sup>57</sup> A 1996 U.S. Geological Study determined that endocrine disruption of carp in Lake Mead was occurring and male carps were turning into females.<sup>58</sup>

Nevada, a state where the federal government owns approximately 87 percent of the land, must have seemed ideal for nuclear testing.<sup>59</sup> Beginning in 1951 and over the next decade, more than 100 nuclear weapons were exploded in the air or on the ground in Nye County (adjacent to and north of Clark County) on a million acres of barren desert located at the Atomic Energy Commission’s (AEC) Nevada Test Site.<sup>60,61</sup> The explosions became an attraction in Las Vegas. The casinos served “Atomic Cocktails,” advertised rooms for their view of mushroom clouds, and also sponsored special picnic lunches or “dawn bomb” parties outside the city to view blasts from a closer vantage point.<sup>62</sup> The Atomic View Hotel advertised, “an unobstructed sight line to the bomb blast from the comfort of one’s lounge chair.”<sup>63</sup> The light from the blasts “lit up Las Vegas in a spectral false midday.”<sup>64</sup>

Despite the attraction of the testing, the reality was grim enough. After the mushroom clouded explosions, men in white suits with Geiger counters would descend on Las Vegas. As far away as Rochester, New York, snowfall would test 10,000 rad counts per minute when the normal count was 400, causing Kodak products to be affected while in production. Government scientists knew

that exposure to even low levels of radiation caused cancer and leukemia. Regardless, the local director at the test site, Albert Graves, repeated to the press that "the test would not be of the slightest danger" to any citizens, not yet realizing that he was already losing his sight from the effects of radiation.<sup>65</sup> While the people, livestock, land, water, and air were being poisoned with radiation, the federal government was pursuing a policy of providing incorrect information to the general public.<sup>66</sup> In 1997, the National Cancer Institute confirmed that tens of thousands of cases of thyroid cancer in the U.S. had been traced to fallout from the tests of the 1950s.<sup>67</sup> Michael Ventura grimly wrote of the bomb viewing outings, "...a lot of those picnickers died young."<sup>68</sup>

The shift to underground testing occurred in 1957, evoking new protests due to the potential for contamination of underground water supplies and earthquakes due to the explosions. Seismic disruptions due to nuclear testing were confirmed in the late 1960s.<sup>69</sup> In 1968, the AEC announced that a number of aftershocks had followed underground nuclear tests.<sup>70</sup>

Toward the end of the century, Las Vegas had one of the highest air pollution indices in North America, in part due to a grid of urban sprawl thrown upon a valley with scant public transportation.<sup>71</sup> Air pollution and smog are caused by primarily by automobile exhaust. The city was placed on a non-compliance alert in 1997, which may ultimately lead to reductions in federal highway funding.<sup>72</sup>

In a National Academy of Sciences report (circa 2000), a scientific committee said that rapid growth in the Las Vegas Valley may one day cause local officials to search for water in areas around the site, where the extent of radioactive contamination is unknown. A scientific committee said that The Nevada Test Site and other federal government locations used to build nuclear bombs "*will never be clean enough to allow public access to the land.*"<sup>73</sup> At many sites, including the Nevada Test Site, radiological and non-radiological hazardous wastes will remain, posing risks to humans and the environment for tens of thousands of years. The report has stated, "Complete elimination of unacceptable risks to humans and the environment will not be achieved, now or in the foreseeable future."<sup>74</sup> A recent poll of Clark County voters recently cited nuclear waste as the most critical issue facing the community.<sup>75</sup>

## VENICE, ITALY—ENVIRONMENTAL ISSUES

During the middle ages, the domestic water supply for Venice was provided by rain water collected from rooftop drains and from courtyards, which were graded to catch runoff and filter it through sand into a cisterns capped by wells.<sup>76</sup> Sewage was dumped into the lagoons. Such practices were not uncommon for a medieval city, and in the case of Venice, were carried on well into modern times. Charles Dickens noted of “the prevailing Venetian odor of bilge water and an ebb tide on a weedy shore.”<sup>77</sup> Still later travel writer Anne Buckland advised visitors that a pocket handkerchief (was) indispensable in passing through the smaller canal, since these were “so many open sewers.”<sup>78</sup>

To accommodate growth, islands were connected and shallow areas were filled creating new land. To facilitate movement and trade, canals, bridges, stone walkways, and docking facilities were constructed. If Venice were planned in the age of the automobile, such creativity may have never occurred. Venice has a long history of accommodating specialized activities by moving them away from the central islands. The glassworks was ordered to the island of Murano in 1292 to lessen the danger of fire.<sup>79</sup> In 1493, the island of Lazzaretto was made a lodging place for the ill.<sup>80</sup>

The lagoon, the biological basis for the city’s life, was a constant concern. The rivers carried silt, a recurring threat which could clog the lagoon. Eventually, dikes were constructed on the landward side to keep out the fresh water, thus changing the ecology of the estuary. Such actions were taken primarily to prevent impacts to shipping, which was vital to the economic success of the city. To protect the three primary seaward entrances to the lagoon, Napoleon ordered that jetties be constructed. The barrier beaches, critical to holding back storms on the Adriatic, were assaulted by the burning of pine trees to clear land and the removal of sand which provided ballast for ships. These actions were eventually prohibited. Some shorelines were strengthened by stone sea walls finished in 1783. These lasted until 1966, when the sea walls were broken by storms which submerged Venice under six feet of water.<sup>81</sup>

By the 1970s, the industries at Porto Marghera were causing pollution, overcrowding, and urban sprawl. The Porto Marghera industrial complex represents one of the major concentrations of Italian industry with chemical and petrochemical plants, metallurgical and en-

gineering works, and thermoelectric stations. Venice continues to be an important commercial port. Affected by only occasional nuclear fallout, such as the Chernobyl Nuclear Power Plant in the Ukraine, significant nuclear damage similar to that occurring to environs of Las Vegas has not occurred.

Another primary cause of pollution in the lagoons is runoff from agricultural wastes and chemicals. Agricultural crop fields were recognized as an important source of nitrogen pollution affecting the Venice lagoon ecosystem.<sup>82</sup> Until the 1960s, management of runoff was characterized by large hedgerow systems and vegetated strips. Most of these were dismantled in the last decades to create a "modern" agricultural cropping system. The Venetian Municipality is presently instituting several actions to control lagoon pollution, including the planting of windbreaks and hedgerows. These are being reintroduced by means of a landscape planning model, accounting for the needs of local agriculture. This low-tech approach has proven effective. The control (with an efficiency of about 50 percent) has been effective for nitrates, the most dangerous pollutant in water quality assessment.<sup>83</sup> In addition, the hedgerows stop more than 85 percent of solids, and consequently provides improved control of total phosphorus.<sup>84</sup>

That Venetians live a few precarious inches above sea level is evident to any of the 10 million visitors who come to the city each year. Its canals teem not only with gondolas and motorboats but also with fish, algae, and seaweed.<sup>85</sup> On hot summer days, the canals at low tide give off a pungent odor said to be based partly on decomposing sea life and partly on the outflows of the ancient and often poorly maintained plumbing.<sup>86</sup> The damages from tidal surges are evident.

Approximately 20,000 people commute to the historic center of Venice daily.<sup>87</sup> Most commuters arrive by train, bus, or automobile via an umbilical cord-like causeway connecting Venice to the mainland. Automobiles are housed at central parking facilities near the maritime center. Others commute by ferry. This mix of commuting technologies minimizes air pollution and reduces traffic congestion. The city plan of Venice, with its winding and sometimes narrow paths and canals, manages to disperse pedestrian traffic and facilitates pedestrian movement. However, Venice's reliance on motorboats creates wave action that over time deteriorates the foundations of the

buildings along the canals. Regulations which slow the speed and reduce the wakes has reduced but not eliminated the impact. On many old buildings, the walls of the ground floors are coated with white corrosive sea salt soaked up by the absorbent bricks, which weakens them and causes them crumble.<sup>88</sup>

Low wooden doors are often stained or rotted away at the bottom because of past flooding, and commercial shop doors often have metal guides that allow the quick installation of waterproof gates.<sup>89</sup> The first floor areas of many residences have been abandoned. Raised walkways are set up in winter floods.

For complex reasons, scientists believe that Venice is sinking faster than ever and in the coming century the encroaching waters of the Adriatic Sea could devastate this celebrated city of art and architecture.<sup>90,91</sup> One cause was the introduction of electric water pumps at Marghera in the 1930s to draw water for irrigation, industrial use, and drinking water.<sup>92</sup> The sinking which had been about 1/2 inch per ten years, has increased to about 2 inches per ten years, varying from place to place.<sup>93</sup> The situation may worsen if global warming causes seas to rise. In fact, surging waters may well overwhelm the main way Italy is planning to fight the danger—79 mobile floodgates meant to cut off the Venetian lagoon and its islands from the highest of the high tides.<sup>94</sup> The plan, drawn up decades ago, is estimated to cost \$2 billion to \$4 billion, and has won backing from Italian companies eager for the work.<sup>95</sup>

## LAS VEGAS: SUSTAINABILITY ISSUES

Las Vegas is a product of the atomic age. Structures are typically designed for an economic life of forty years or less. It can be argued that the city is not designed for permanence. The lack of water in the Las Vegas Valley may limit future growth. After all the water was used, more has to be found. For Las Vegas, there was always been plenty of land and not enough water.

It can be argued that since the city was built on land that was not farmable, the selection of the site for Las Vegas might be considered environmentally appropriate. Despite the desert environment, Las Vegas certainly facilitates growth. However, without significant inputs of resources such as energy and water, Las Vegas could not



More than two decades of hands-on, time-tested experience gives you every tip, table and technique you need to accurately bid on and win more mechanical contracting jobs...

# NATIONAL MECHANICAL ESTIMATOR

TWENTY-FIFTH EDITION

By Ottaviano Technical Services

Now available in this newly revised and updated edition, this best-selling reference is designed to bring you up to speed in today's competitive market with the latest, most advanced estimating techniques in the industry, saving you hours of time and effort. You'll find numerous quick-reference tables that eliminate many calculations that you previously did yourself. Now you can get instant answers at a glance and take the guesswork out of bidding....prepare accurate bids to win the big money contracts....turn out on-target estimates faster and easier than ever before....speed and simplify your estimating chores with instant-reference charts and tables....and accurately analyze and estimate every aspect of each HVAC job. The chapter on budget estimating has been brought completely up to date, and reflects current prices. An important new section on recovering shop burden has been added, along with a valuable section on productivity which incorporates Dr. Deming's fourteen points.

ISBN: 0-88173-355-5



## CONTENTS

- 1 - Budget Estimating
- 2 - Estimating Metal and Fiberglass Ductwork, the New Method
- 3 - Estimating Insulation for Piping and Ductwork
- 4 - Estimating Piping
- 5 - Estimating Piping Hook-ups of Boilers, Fan Coils, Chillers, Etc.
- 6 - Estimating Controls and Control Wiring
- 7 - Estimating Power Wiring
- 8 - Estimating Air Pollution Abatement Devices
- 9 - Estimating Service
- 10 - Estimating by Computer
- 11 - Practical Theory of Bidding
- 12 - Appendix

**ORDER CODE: 0486**

8 1/2 x 11, 950 pp., Illus.  
Softcover, \$140.00

# BOOK ORDER FORM

① Complete quantity, book title, order code, price and amount due for each book you wish to order:

Quantity	Book Title	Order Code	Price	Amount Due
	<b>National Mechanical Estimator, Twenty-fifth Edition</b>	<b>0486</b>	<b>\$140.00</b>	

② Indicate shipping address: **CODE: Journal 2001**

NAME (Please print) \_\_\_\_\_ BUSINESS PHONE \_\_\_\_\_

SIGNATURE (Required to process order) \_\_\_\_\_

COMPANY \_\_\_\_\_

STREET ADDRESS ONLY (No P.O. Box) \_\_\_\_\_

CITY, STATE, ZIP \_\_\_\_\_

③ Select method of payment:

- CHECK ENCLOSED
- CHARGE TO MY CREDIT CARD
  - VISA     MASTERCARD     AMERICAN EXPRESS

Make check payable in U.S. funds to:  
**AEE ENERGY BOOKS**

Send your order to:  
**AEE BOOKS**  
P.O. Box 1026  
Lilburn, GA 30048

INTERNET ORDERING  
[www.aeecenter.org](http://www.aeecenter.org)

TO ORDER BY PHONE  
Use your credit card and call :  
**(770) 925-9558**

TO ORDER BY FAX  
Complete and Fax to:  
**(770) 381-9865**

CARD NO.

Expiration date \_\_\_\_\_ Signature \_\_\_\_\_

### INTERNATIONAL ORDERS

Must be prepaid in U.S. dollars and must include an additional charge of \$10.00 per book plus 15% for shipping and handling by surface mail.

Streamline and economize your maintenance using easy to follow, step-by-step guidelines...

# PRINCIPLES OF CONTROLLED MAINTENANCE MANAGEMENT



By P. Dale Johnson

An effective, well-managed maintenance program is crucial to the efficient and economical performance of any type of facility. This book presents a complete, step-by-step guide to systematically improving overall maintenance operations, covering maintenance organization, inventory, continuous inspection, planning, scheduling and program management. The presentation is structured in a manner which allows the reader to utilize basic guidelines in implementing a management system which can be customized to the specific requirements and goals of his/her plant or facility, regardless of size or type of operation.

ISBN: 0-88173-354-7

**ORDER CODE: 0485B**

6 x 9, 137 pp., Illus.  
Hardcover, \$88.00

## CONTENTS

- 1 - Introduction
- 2 - Principles of Controlled Maintenance
- 3 - Inventory and History Files
- 4 - Continuous Inspection
- 5 - Work Classification
- 6 - Work Input Control
- 7 - Planning and Estimating
- 8 - Material Coordination
- 9 - Scheduling
- 10 - Work Performance
- 11 - Buildings and Grounds
- 12 - Predictive Maintenance
- 13 - Cost Accounting
- 14 - Sample Forms
- 15 - Suggested Starting PMI Frequencies
- Index

## BOOK ORDER FORM

① Complete quantity, book title, order code, price and amount due for each book you wish to order:

Quantity	Book Title	Order Code	Price	Amount Due
	<b>Principles of Controlled Maintenance Management</b>	<b>0485B</b>	<b>\$88.00</b>	

② Indicate shipping address: **CODE: Journal 2001**

NAME (Please print) \_\_\_\_\_ BUSINESS PHONE \_\_\_\_\_

SIGNATURE (Required to process order) \_\_\_\_\_

COMPANY \_\_\_\_\_

STREET ADDRESS ONLY (No P.O. Box) \_\_\_\_\_

CITY, STATE, ZIP \_\_\_\_\_

③ Select method of payment:

- CHECK ENCLOSED
- CHARGE TO MY CREDIT CARD
  - VISA     MASTERCARD     AMERICAN EXPRESS

Make check payable  
in U.S. funds to:  
**AEE ENERGY BOOKS**



Send your order to:  
**AEE BOOKS**  
P.O. Box 1026  
Lilburn, GA 30048

INTERNET ORDERING  
[www.aeecenter.org](http://www.aeecenter.org)

**TO ORDER BY PHONE**  
Use your credit card and call:  
**(770) 925-9558**

**TO ORDER BY FAX**  
Complete and Fax to:  
**(770) 381-9865**

CARD NO.

Expiration date \_\_\_\_\_ Signature \_\_\_\_\_

### INTERNATIONAL ORDERS

Must be prepaid in U.S. dollars and must include an additional charge of \$10.00 per book plus 15% for shipping and handling by surface mail.

have been built and would not have survived. While hydropower can be argued to be a sustainable energy resource, construction of Boulder Dam occurred prior to significant environmental concerns about saving wild rivers, destroying maritime habitat, and environmental impact statements. The dam effectively reduced water flow to portions of northern Mexico and changed the environment of the lower Colorado River Basin.

Las Vegas was the city nearest to where the nuclear age began, only 65 miles from the primary North American testing site. As a result, vast portions of Nevada Desert were laid to waste. Even so, the environmental impacts of the atomic age activities were not widely understood. As a result, Las Vegas benefited from short-term employment opportunities that were offered by the development of nuclear power but also suffered from its long term and generally misunderstood effects.

Traffic movement, or lack of it, also effects the environment. Robert Parker observed that " At peak time, it takes up to 30 minutes to travel the two blocks from Tropicana Avenue to Flamingo Road on the strip. As a result of the traffic glut... air quality has deteriorated."<sup>96</sup> With more vehicles emitting more carbon monoxide, together with construction, high winds, and dust, air quality continues to be problematic.<sup>97</sup>

Does Las Vegas demonstrate sustainable development? By modern standards, the casino hotels of Las Vegas are almost uninhabitable without mechanically induced air conditioning systems. While air pollution is growing due to greater use of automobile transportation, the answer lies in the lack of extensive water resources which at the least creates limits to future growth. Development demands on the water supply and increases in pollution are likely increased by runaway construction, described by one observer as "an unreadable chaos of non-planning."<sup>98</sup> More creative and more widely deployed water conservation measures will be required in the future simply to more efficiently manage the available resources. Unless additional water resources are found, the rapid growth of Las Vegas can be viewed as non-sustainable, as it may not foster long-term habitation given its plans for continued urban growth. The city at the least may have a population limit, beyond which growth is limited by water supplies and as a result, sustainability is impeded.

## VENICE: SUSTAINABILITY ISSUES

Venice has survived for hundreds of years, demonstrating significant sustainability. Like Las Vegas, it can be argued that the site selection of the city was sustainable since prime agricultural land was not used. Its stone buildings were constructed to last hundreds of years. The lack of land mass in the central part of the lagoon certainly limited growth. There was always too much water and not enough land. After all the land was used, more land had to be made. In order to survive, Venetians had to find ways to import substantial quantities of food and harvest timber from the mainland for trade. Venice was forced to mold the lagoon into a usable form to facilitate construction, develop water-based transportation systems and expedite pedestrian movement. The city has also redesigned itself several times, growing by enlarging the islands in its estuary and forcing industrial development away from the central city in order to protect its waterways and architectural heritage.

Venice developed as a result of transportation technologies available in the middle ages. The city exploited the more efficient means of transporting people and cargo over water rather than land. Unlike other cities in Europe, the doorway to the water was literally at the doorway to everyone's home. Transportation by way of water reduced urban air pollution in the central city. This provided for sustainable growth for hundreds of years, a time of comparatively slower technological change. In addition, urban densification occurred due to both the pedestrian nature of the city and the high costs of adding new land mass.

Venice's population has suffered from the nightmares of disease and plague, often resulting in significant losses of population, yet has always managed to survive. It is interesting that over the centuries, the population of the original islands of Venice has fluctuated within a range from 80,000 to 160,000 inhabitants with growth accommodated by mainland construction.

Since there were no railroads, no automobiles, and no airplanes, these central features of our modern cities were not included in the original design of Venice. However, it is interesting that as these transportation technologies came available, they were accommodated for in a manner that failed to significantly effect Venice's urban form. A causeway was constructed to bring auto and rail transportation to

the edge of the original city and an airport was built on the mainland. In addition, the seaport was moved and enlarged.

Venice has a history of responding with legislation to stem environmental problems. Examples include regulations to limit sand removal and tree removal from barrier islands. The primary sustainability problem for Venice is too much water due to tides and floods augmented by the stormy winds of the Adriatic.

Does Venice demonstrate sustainable development? The dumping of sewage into the lagoons was a misuse that must have impacted aquatic life. However, in many ways, it has passed the test of time. The long-term sustainability issue for Venice deals in part with environmental changes which are beyond her control. If global warming does raise Adriatic water levels further, the problem may be even more difficult to resolve. The answer for Venice also lies in the ability to engineer and implement effective control of the waves, tides, and storms of the Adriatic and their effects on the lagoons. The sinking due to water pumping and other factors must be halted.<sup>99</sup> Finally, creative ways of restoring buildings and foundations must be found. Unless Venice solves the problem of the rising seas, future sustainability is indeed questionable.

## SUMMARY

Both Venice and Las Vegas have created distinctive urban forms and international urban images. Both were constructed in locations which avoided the use of valuable farmland. Venice, a distinctively European city which flourished from the 9th to the 16th centuries was constructed on islands in a shallow lagoon. Las Vegas, a unique North American city, is an example of a new city born on relatively useless land with sandy alkaline soil conditions. Both have experienced continuing difficulties with water pollution. Both cities are major tourist centers. Both are sinking due to the tapping of underground water sources. While both demonstrate certain aspects of sustainable development, both also have significant long term sustainability problems. Environmental issues appear to limit their future viability. Las Vegas suffers from a lack of water resources; Venice suffers from an abundance of water. Both factors concern their cities' future welfare, limit future growth, and are key issues in assessing

their sustainability. Spatial mismatch between employment and residential centers is found in both cities.

While both Las Vegas and Venice are places to visit and perhaps to work, Venice is also a cultural amenity to be lived in. Venice invites strolling and idleness. Sundials in Venice are inscribed with the words: *Horas non numero nisi serenas* (I count only the happy hours). Las Vegas seems temporal by comparison. Other observers are more outspoken. Parker notes "Las Vegas explicitly advertises itself as a fake neon city, and hundreds of thousands of people flock there every year precisely because it delivers on its promise."<sup>100</sup> Its 1995 tourism campaign was named: "Las Vegas—Open 24 hours."

Regardless, Las Vegas is preparing for continued and explosive growth, planning its buildings for a short life span. Afterwards they will have lost their usefulness, be modified, torn down, and perhaps rebuilt. Meanwhile, Las Vegas suffers from air and water pollution on a significant scale. Access to water is an important limiter of growth. Without creative management of water resources, the long-term future of Las Vegas is in question.

Venice is creatively trying to maintain its centuries-old architecture, restore its valuable treasures. The high cost of bringing fill to create land for construction limited growth in its early history, yet provided incentive to jettison its industries to other islands and to the mainland. Today, as in the past, the health of its lagoons relates directly to the viability of the city. Unless the root causes of the sinking of Venice are resolved by engineered solutions, Venice may one day find itself uninhabitable during certain periods of the year.

## CLOSING COMMENTS

The discussions concerning the environmental issues relative to Las Vegas and Venice is not all-encompassing and suffers from significant omissions. The relatively recent redefinition of the metro area for Venice includes areas that were formerly mainland industrial cities. A more detailed discussion of the metro area's environmental issues is needed. For example, the subjects of oil, lead, and mercury contamination of the Venetian lagoons by industry was not been discussed. The environmental contamination from numerous sources such as leaded gasoline and sulfur oxides was not detailed.

One might raise the question: Which city demonstrates greater sustainability? Depending on what evidence is used to answer the question, either might better demonstrate greater urban sustainability. Other aspects of urban sustainability (e.g. as public health, energy usage, housing quality, etc.) would need to be considered at length. Future study might identify and gain academic consensus on all key aspects of urban sustainability, prioritize the list of key elements, place scaled values on each aspect, and compare the results which apply to these cities and others.

### **Bibliography**

- Andrieux, Maurice (1972). *Daily Life in Venice in the Time of Casanova*. New York and Washington: Praeger Publishers.
- Brooke, Stopford A. (1907). *The Sea-Charms of Venice*. New York: E.P. Dutton and Company.
- Banham, Reyner (1969). *The Architecture of the Well-Tempered Environment*. London: The Architectural Press.
- Beatley, Timothy (2000). *Green Urbanism: Learning from European Cities*. Washington, D.C.: Island Press. Sage Publications.
- Blair, J.P. (1995). Local Economic Development. *Market Areas & Economic Development Strategies*.
- Butti, Ken & Perlin, John (1980). *A Golden Thread: 2500 Years of Solar Architecture and Technology*. Palo Alto, CA: Cheshire Books.
- Broad, William J. "That Sinking Feeling Again, as Venice's Past Haunts City's Future." *New York Times*. 29 August 2000.
- Denton, Sally and Morris, Roger (2001). *The Money and the Power, The Making of Las Vegas and Its Hold on America, 1947-2000*. New York: Alfred A. Knopf.
- DiGaetano, Alan & Klemanski, John S. (1999). *Power and City Governance—Comparative Perspectives on Urban Development*. Minneapolis, Minnesota: University of Minnesota Press.
- Drakakis-Smith, David (2000). *Third World Cities*. London and New York: Routledge.
- Edel Matthew & Rothenburg, Jerome (ed.) (1972). *Readings in Urban Economics*. New York: Macmillian Company.
- Elliott, Russell R. (1973). *History of Nevada*. Lincoln, Nebraska: University of Nebraska Press.
- European Commission (March 1996). *European Sustainable Cities*. Directorate General XI, Brussels.

- Franco, Daniel and Perelli, Marino and Scattolin, Mario (1996). *Buffer strips to protect the Venice Lagoon from non point source pollution*. Proceedings of the International conference on buffer zones, their processes and potential in water protection. Heythrop, UK.
- Goodman, Oscar B. (2002). *City of Las Vegas Budget in Brief for fiscal year 2002*. Las Vegas, Nevada.
- Goodman, Oscar B. (2002). *Mayor's State of the City Address, Las Vegas, Nevada*. Las Vegas: City of Las Vegas Communications Director.
- Honour, Hugh (1966). *The Companion Guide to Venice*. New York: Harper and Row Publishers.
- Howells, W. D. (2001). *Venetian Life*. Evanston, Illinois: The Marlboro Press and Northwestern University Press.
- Hulse, James W. (1998). *The Silver State*. Reno, Nevada: University of Nevada Press.
- Lane, Frederic C. John (1973). *Venice A Maritime Republic*. Baltimore and London: Hopkins University Press.
- Laxalt, Robert (1977). *Nevada, A Bicentennial History*. New York: W.W. Norton & Company, Inc.
- Le Corbusier (1971). *The City of Tomorrow*. The Architectural Press: London.
- Links, J. G. (1966). *Venice for Pleasure*. London: The Bodley Head
- Littlejohn, David (1999). *The Real Las Vegas*. Oxford and London: Oxford University Press.
- Mccadam, Alta (1987). *Blue Guide Venice*. New York: W. W. Norton.
- Morris, James (1960). *Venice*. London: Faber and Faber.
- Naisbitt, John (1994). *Global Paradox*. New York: Avon Books.
- Neff, Erin. *Poll Cites Nuclear Waste as Top Concern, Voters Rate Economy as Second Most Critical Issue*. Las Vegas Sun. 22 February 2002.
- Norberg-Schulz, Christian (1965). *Intentions in Architecture*. Cambridge Massachusetts: The M.I.T. Press.
- Pemble, John (1995). *Venice Rediscovered*. Oxford England: Clarendon Press.
- Rowdon, Maurice (1970). *The Silver Age of Venice*. New York: Prager Publishers.
- Rudd, Dennis R. & Fainstein, Susan S. ed. (1999). *The Tourist City*. New Haven and London: Yale Press.



- U.S. Census Bureau (1999). *American Factfinder for Clark County Nevada*.
- U.S. Census Bureau (1999). *County Business Patterns for Clark County Nevada*.
- U.S. Census Bureau (2000). *Statistical Abstract of the United States—Table No. 946, Energy Consumption by End-Use Sector and Selected Source by State 1997*.

---

#### ABOUT THE AUTHOR

**Stephen A. Roosa** is the president of Energy Management Alternatives, Inc. During a recent five-year period at a utility owned energy services company, he was the lead energy engineer for energy and water service contracts. Previous experience includes 20 years experience in energy engineering and energy management with energy studies performed on over 3,500 buildings.

Mr. Roosa received a Bachelor of Architecture degree from the University of Kentucky and a Masters in business administration (MBA) from Webster University. He is an Association of Energy Engineers (AEE) Certified Indoor Air Quality Professional (1998) and an AEE Certified Energy Manager (1986).

Related professional awards include the Federal Energy and Water Management Project Award (1999); US Army Corps of Engineers National Energy Systems Technology Award, CENET (1991); US DoD Energy Conservation Award (1989); AEE International Energy Manager of the Year (1987); US Joint Chiefs of Staff Citation for Energy Management (1983). Mr. Roosa has served in the following capacities: AEE Bluegrass Chapter President (1986-7) ASHRAE Kentucky Chapter Vice President (1992-93), and AEE Southeast Regional Vice President (1988-89).



## Acknowledgments

The author wishes to thank Dr. Hank Savitch, University of Louisville for his personal interest and support in regard to this article.

## Note

The views expressed herein are solely those of the author and do not necessarily reflect the views of any other individual, organization, corporation or agency. Mention or reference to trade names, governmental agency or commercial enterprise does not constitute endorsement.

## References

- <sup>1</sup>Note: Las Vegas in Spanish translates as "the meadows." Nevada translates as "snow covered" or "snow capped."
- <sup>2</sup>Denton, Sally and Morris, Roger (2001). *The Money and the Power, The Making of Las Vegas and Its Hold on America, 1947-2000*. New York: Alfred A. Knopf. p.6. Denton and Morris also state (p. 7) that, "Upward from a dark glass pyramid beams a searchlight of 40 billion candlepower, said to be the brightest ray in the solar system, save for the sun or a nuclear blast."
- <sup>3</sup>Mestre is now part of metropolitan Venice.
- <sup>4</sup>Muraru, Michelangelo & Graber, Andre (1963). *Treasures of Venice*. World Publishing Co. p. 20.
- <sup>5</sup>Norberg-Schultz, Christian. *Intentions in Architecture*. p. 156.
- <sup>6</sup>Beatley Timothy (2000). *Green Urbanism*. p. 17.
- <sup>7</sup>*Ibid.* p. 16.
- <sup>8</sup>European Commission (1996) European Sustainable cities. Directorate General XI, Brussels. p. 6-7.
- <sup>9</sup>Drakakis-Smith, David (2000). *Third World Cities*. p. 8.
- <sup>10</sup>Note: *Vaporetto* derives from the Italian word for "steamer." However, the boats today are propelled by diesel and gasoline engines.
- <sup>11</sup>Denton and Morris. p. 7.
- <sup>12</sup>*Ibid.*
- <sup>13</sup>Goodman, Oscar B. (2002). *Las Vegas State of the City Address*, 7 January 2002.
- <sup>14</sup>Le Corbusier (1971). *The City of Tomorrow*. The Architectural Press. London. p. 11.
- <sup>15</sup>Venice was also once a place where many gambled their fortunes away.
- <sup>16</sup>Laxalt, Robert (1977). *Nevada, A Bicentennial History*. New York: W.W. Norton & Company, Inc. p. 37.
- <sup>17</sup>*Ibid.* Data from map on p. 31.
- <sup>18</sup>Denton and Morris. p. 7.
- <sup>19</sup>Rudd, Dennis R. & Fainstein, Susan S. ed. (1999). *The Tourist City*. New Haven and London: Yale Press. p. 122.
- <sup>20</sup>*Ibid.*
- <sup>21</sup>Lane, Frederic C. (1978). *Venice*. p. 1.
- <sup>22</sup>*Ibid.* p. 8.
- <sup>23</sup>*Ibid.*

<sup>24</sup>Broad, William J. "That Sinking Feeling Again, as Venice's Past Haunts City's Future." *New York Times*. 29 August 2000.

<sup>25</sup>*Ibid.*

<sup>26</sup>Elliott, Russell R. (1973). *History of Nevada*. Lincoln, Nebraska: University of Nebraska Press. p. 314.

<sup>27</sup>*Ibid.* p. 325.

<sup>28</sup>Denton and Morris. p. 100.

<sup>29</sup>Lane, Frederic C. *Venice*. p. 18.

<sup>30</sup>*Ibid.* p. 19.

<sup>31</sup>*Ibid.*

<sup>32</sup>*Ibid.* p. 21.

<sup>33</sup>Lane traces the development of Venice from its early history through the 1960s dealing with the growth of the city, the structural influences which framed growth and political actions. Population estimates are provided for various periods of her history. The last chapter delves into details of how industrialization and oil usage intensified threats to the lagoons.

<sup>34</sup>*Ibid.* p. 454.

<sup>35</sup>Elliott, Russell R. (1973). *History of Nevada*. Lincoln, Nebraska: University of Nebraska Press. p. 9.

<sup>36</sup>*Ibid.*

<sup>37</sup>Laxalt, Robert (1977). *Nevada, A Bicentennial History*. New York: W.W. Norton & Company, Inc. p. 116.

<sup>38</sup>Elliott, p. 172.

<sup>39</sup>Littlejohn, p. 135.

<sup>40</sup>Hulse, James W. (1998). *The Silver State*. Reno, Nevada: University of Nevada Press. p. 214.

<sup>41</sup>Note: An acre foot = 326,000 gallons, ample enough to supply two families of four people for a year.

<sup>42</sup>Denton and Morris. p. 144.

<sup>43</sup>*Ibid.* p. 145.

<sup>44</sup>Lexant. p. 122.

<sup>45</sup>*Ibid.* p. 121.

<sup>46</sup>Hulse, p. 239-240.

<sup>47</sup>*Ibid.*

<sup>48</sup>Denton and Morris. p. 364.

<sup>49</sup>Littlejohn, David (1999). *The Real Las Vegas*. Oxford and London: Oxford University Press. p. 8-9.

<sup>50</sup>Littlejohn. p.8-9.

<sup>51</sup>Note: Other city water usage: Phoenix, Arizona, with six times as many golf courses uses 250 gallons per capita per day; Sante Fe, New Mexico, 160 gallons per capita per day; Tucson, Arizona, 155 gallons per capita per day. See also Littlejohn, p. 9. and pages 133-148 for a detailed discussions which credits the high usage primarily lawn watering in a desert environment with alkaline soil conditions.

<sup>52</sup>Littlejohn. p. 35.

<sup>53</sup>*Ibid.* p. 133.

<sup>54</sup>*Ibid.* p. 121.

<sup>55</sup>Littlejohn. p. 137.

<sup>56</sup>*Ibid.*, Sewage discharges are within federally mandated limits.

<sup>57</sup>*Ibid.*

<sup>58</sup>*Ibid.* p. 138.

<sup>59</sup>*Ibid.* p. 121.

<sup>60</sup>Nye County Nevada is adjacent to and northwest of Clark County. The AEC was later renamed the Energy Research and Development Administration.

<sup>61</sup>*Ibid.* p. 138-40.

<sup>62</sup>*Ibid.*

<sup>63</sup>Denton and Morris. p. 140.

<sup>64</sup>*Ibid.* p.141.

<sup>65</sup>*Ibid.*

<sup>66</sup>*Ibid.* Denton and Morris provide an in-depth discussion of the misinformation campaign in Chapter 9.

<sup>67</sup>Hulse. p. 343.

<sup>68</sup>Denton and Morris. p. 142.

<sup>69</sup>Elliot reports that, "...underground testing of nuclear devices has not been completely concerned with military uses. In 1962, the AEC initiated the Plowshare Program to find peaceful uses for atomic energy. Under this program the scientists at the Nevada Test Site have conducted tests to determine the possibilities of using atomic power to dig harbors and canals, for road building, and for other types of excavation. Two other potential uses of atomic power, in mining and in developing underground water sources are of particular interest to Nevadans." p. 314.

<sup>70</sup>Elliot. p. 339.

<sup>71</sup>Denton and Morris. p. 365.

<sup>72</sup>Littlejohn. p. 35.

<sup>73</sup>Manning, Mary. *Report Says Cleanup of Test Site Impossible*. Las Vegas Sun. 8 August 2000.

<sup>74</sup>*Ibid.*

<sup>75</sup>Neff, Erin. "Poll cites Nuclear Waste as Top Concern, Voters Rate Economy as Second Most Critical Issue." *Las Vegas Sun*. 22 February 2002.

<sup>76</sup>Lane, Frederic C. *Venice*. p. 206.

<sup>77</sup>Pemble, John (1995). *Venice Rediscovered*. Clarendon Press: Oxford. p. 20.

<sup>78</sup>*Ibid.* p. 21.

<sup>79</sup>Lane, Frederic C. *Venice*. p. 16.

<sup>80</sup>*Ibid.* p. 18.

<sup>81</sup>*Ibid.* p. 452.

<sup>82</sup>Franco, Daniel and Perelli, Marino and Scattolin, Mario (1996). *Buffer strips to protect the Venice Lagoon from non point source pollution*. p. 1.

<sup>83</sup>*Ibid.* p. 4.

<sup>84</sup>*Ibid.*

<sup>85</sup>Broad, William J. "That Sinking Feeling Again, as Venice's Past Haunts City's Future." *New York Times*. 29 August 2000.

<sup>86</sup>*Ibid.*

<sup>87</sup>Lane, Frederic C. *Venice*. p. 457.

<sup>88</sup>Broad, William J. That Sinking Feeling Again, as Venice's Past Haunts City's Future. *New York Times*. 29 August 2000.

<sup>89</sup>*Ibid.*

<sup>90</sup>*Ibid.*

<sup>91</sup>Pemble in Chapter VI traces the first empirical evidence of the sinking of Venice and a few of the early theories as to why it was occurring. One of the causes was an attempt to divert river water to reduce a perceived cause of malaria. The unintended effect of enhancing changes to the estuary which contributed to the sinking.

<sup>92</sup>Lane, Frederic C. *Venice*. p. 456.

<sup>93</sup>*Ibid.*

<sup>94</sup>Broad, William J. "That Sinking Feeling Again, as Venice's Past Haunts City's Future." *New York Times*. 29 August 2000.

<sup>95</sup>*Ibid.*

<sup>96</sup>Rudd, Dennis R. & Fainstein, Susan S. ed. (1999). *The Tourist City*. New Haven and London: Yale Press. p. 122.

<sup>97</sup>The Las Vegas city budget identifies several city goals including: 1) Enhancing our urban landscape; 2) Expanding transportation; 3) and Contributing to a safe environment. The budget provides economic information to determine the direction and costs of meeting these goals.

<sup>98</sup>Denton and Morris. p. 364.

<sup>99</sup>Note: Given the compact nature of the historical center, I wonder if there might be a way to selectively pump massive volumes of water (after all the lowering of the water table is a cause of the sinking) or some other more stable material under the city and simply jack it up a few feet, offering Venice a couple hundred years of life until a better solution could be found.

<sup>100</sup>Rudd, Dennis R. & Fainstein, Susan S. ed. (1999). *The Tourist City*. New Haven and London: Yale Press. p. 6.