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# Relating Spatial Quality of Public Transportation and the Most Visited Museums: Revisiting Sustainable Mobility of Waterfronts and Historic Centers in International Cruise Destinations

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**Abstract:** Museums are main tourist resources for independent cruise passengers in cultural cruise destinations. However, their influence on cruise destinations is scarcely analyzed. The aim of this paper was to focus on two questions: What distribution of museums facilitates a sustainable mobility of cruise tourists in balance with urban needs? And which factors affect the potential use of both means of sustainable travel—soft mobility and public transport—at cruise destinations? The network topological features of main museums were analyzed to compare similar features among tourism destinations. A topological study based on the model of the three urban fabrics was related to the objective quality of PT. This allowed for a greater walkability or potential use of PT to be estimated. The results allowed for a diverse sample of cultural tourism port cities with cruise activity to be classified in three centralized levels and two decentralized ones. Results indicated that centralized networks are more prone to cruise tourists, while decentralized networks are more related to main cultural destinations. Finally, the discussion section analysed recommendations and measures to improve sustainable mobility and the planning of new museums. The results of this paper will be of interest to cultural and transport managers at these types of destinations.

**Keywords:** historic center; accessibility; cultural tourism; mobility; cruise tourism

**Citation:** Rosa-Jiménez, C.; Gutiérrez-Coronil, S.; Márquez-Ballesteros, M.J.; García-Moreno, A.E. Relating Spatial Quality of Public Transportation and the Most Visited Museums: Revisiting sustainable Mobility of Waterfronts and Historic Centers in International Cruise Destinations. *Sustainability* **2023**, *15*, 2066. https://doi.org/10.3390/su15032066

Academic Editor: Jun (Justin) Li

Received: 8 December 2022
Revised: 16 January 2023
Accepted: 19 January 2023
Published: 21 January 2023



## 1. Introduction

Museums are the pinnacles of cultural tourism [1] and are the most popular draws, usually followed by art galleries and monuments [2]. The opening of a museum plays a positive role in increasing visitor arrivals, as they are must-visits and one of the most valuable assets [3]. Studying museums provides a good benchmark to analyze tourist mobility at cultural destinations, as cultural tourism tends to participate in the same types of activities regardless of the destination [4]. Museums benefit from spatial agglomeration [5], so their concentration creates important tourist attraction areas. In addition, and unlike monuments, museums have greater flexibility in their creation and location.

The balanced progress of tourism and transportation increases the local economy and international competitiveness [6]. Sustainable mobility at tourist destinations tends to foster the use of public transport (PT), along with the development of soft mobility. This term includes any non-motorized transport (human-powered mobility) [7].

The study of accessibility from the approach of potential transport options is essential for destination planning and management, especially from the cruise tourist's point of view, since local governments are increasingly encouraging the inclusion of cities in the largest number of international itineraries because of the economic benefits they generate.

In Helsinki, recent studies have reported that only 35% of cruise passengers arriving at the port move independently out of the port, compared to 60% who take organized tours [8]. For independent cruise passengers, the limited stopover times make exploring the historic center and the most-visited-museums (MVMs), proportional to the accessibility and use of PT [9]. The potential accessibility of cruise tourists using sustainable mobility—beyond organized tours or using vehicles (taxis and rental vehicles)—will depend on its appeal, on the potential use of PT connections or the proximity of the cruise terminals for soft mobility.

The aim of this paper was to study independent cruise passengers travelling either to the historic center and the MVMs by soft mobility or using PT with a focus on two questions: What distribution of museums facilitates a sustainable mobility of cruise tourists in balance with urban needs? And which factors affect the potential use of both means of sustainable travel at cruise destinations?

Sustainable mobility in tourist destinations has been widely analyzed in the scientific literature. However, this literature has ignored the influence of museums on cruise destinations. This paper aimed to address the gap in the literature regarding the potential routes that tourists follow when visiting the destination [10,11]. The first part reviewed the state of the art regarding the main variables determining the potential use of PT. In the second part, the structure of museum destination networks was analyzed in order to compare whether the tourism pattern shares certain structural properties. This methodology is suitable for examining the network features of multiple destinations and thereby, to specify their level of centrality. This paper focused on links among museums, characterized as nodes, to describe a territorial network of museum offer by mapping the spatial distribution of potential tourism mobility [12]. The network topological features of main museums were analyzed to compare similar features among tourism destinations. The empirical data of the MVMs (number of visits, international ranking) were related to the objective quality of the potential medium- and high-capacity PT (not including the taxi), using a topological study based on the model of the three urban fabrics [13]. In the third part, the results allowed for a diverse sample of cultural tourism port cities with cruise activity to be classified according to their degrees of centrality. This allowed for a greater walkability or potential use of PT to be estimated. Finally, the discussion section analysed the recommendations and measures to improve sustainable mobility and the planning of new museums. The results of this paper will be of interest to cultural and transport managers at this type of destinations.

## 2. Literature Review

Studies on the mobility of cruise passengers at destination are scare in the scientific literature. On an urban level, some researchers have focused on detecting patterns and ranges of travel in Mediterranean destinations [14], while other authors have analyzed the urban factors that facilitate the walking mobility of cruise passengers in destinations [8]. At the territorial level, several authors have seen great potential in the regionalization of displacement [15]. However, in both cases, this literature has ignored the influence of museums on cruise tourism destinations.

Soft mobility is influencing the reshaping of urban waterfronts by helping to establish new patterns of social and economic activity, increasing the quality and attractiveness of urban areas, especially in the redevelopment of historic centers [16]. Its link to healthy cities translates into the development of promenades and pedestrian zones as tourist attractors and healthy environments in both historic centers and urban waterfronts [17,18], and even in the reuse of disused railway lines for future pedestrian and cycle paths [18]. However, some authors have shown that cycling is more preferred among young tourists, while the use of electric or hybrid buses is more widespread among tourists [19].

### *2.1. Accessibility*

The study of the potential accessibility of cruise tourists to visit museums has been scarcely analyzed in the scientific literature. With respect to passenger transport, accessibility is defined as: *"the extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s)"* [20] (p. 128). Those authors divided the accessibility policies into four approaches: urban and geographical studies, individual level, economic benefits, and transport planning [21].

From the urban approach, some scholars highlighted a balanced distribution in the potential accessibility to residents to visit museums in the Helsinki Metropolitan Area—in order to guarantee accessibility to the residents in 30- and 60-min slots in a nearby museum [21. In the spatial distribution of museums in urban regions, the literature seems to indicate a gravitational and concentric model around a historic center, e.g., Greater London [5,22].

As regards the type of user, the profile of the tourist is opposite to that of the resident, as they do not know their destination and its transport system, and they try to visit the greatest number of tourist resources during their stay. Therefore, the cruise tourist or groups of motivated cruise tourists, who do not opt for organized tours, must have access to the Internet and want to visit the city by themselves. Conversely, the short time amount of time that cruise passengers have to visit the destination means they tend to stay within a 3-km radius of the cruise terminal [14].

From the economic perspective, the literature has demonstrated the viability of cruise tourists in the use of sustainable mobility [19], while other authors have calculated an accessibility index according to the cost of the journey and the appeal of the museums and galleries [22].

Finally, from the planning transport perspective, tourists depend on transport options to travel between the destinations' local draws [23]. On islands or at small destinations, cruise passengers use walking or PT buses for the close main attractions, and rent cars or travel on touristic buses for attractions that are located farther away [19]. In destinations with a more advanced PT systems, the literature proposes subway, tram and buses, as alternatives to cars (hired or taxis). Tourists in urban destinations use the subway more often as they have fewer expectations regarding travelling by bus [24]. For metropolitan or regional journeys to museums, the train is the most recommended means of transport [21].

### 2.2. Potential Use of PT

Transport systems can be considered as complex networks. The network topology is the physical connection of elements of a network, such as links and nodes [25]. Compared to studies analyzing the topology of public transport networks from the focus on tourism and its degree of centrality [26], this study used a novel approach to focus on the potential user and the individual assessment of each means of transport used.

The use of PT is related to the satisfaction with the destination [27] maintained throughout the journey and depends on access to a developed local system [28]. The quality of the PT depends on subjective (q) and objective (Q) indicators [29]: q is related to the general satisfaction of tourists and analyzed by means of user perception surveys [30,31], or specific surveys for tourists [31–33], while Q corresponds to quantifiable factors. Q determines the potential use of PT by the tourist that visits a destination for the first time. Factors impacting on Q can be reduced to five aspects [34,35]: information, time, cost and means of payment, availability, and environmental impact. Information and time are decisive for tourists opting for other means of transport if these are not satisfactory [34].

Information on the PT system and access to the destination resources are fundamental reasons for visiting [11,36]. At present, the use of new technologies—such as smartphones that allow for the information to be consulted in real time—stimulates the use of PT [11]. This is also the case regarding the ease of buying tickets and the number of languages on the platform.

Time limits the number of resources to be visited [37]. An extremely long PT journey will put tourists off visiting a place, or they may opt for private or individual transport, which is usually quicker [38].

As regards the cost and means of transport, the literature highlights the different types of card systems as a factor that improves its use [39]. The availability of multimodal tickets (tourist travel cards), such as 24-h travel cards, encourages visitors to use PT [38]. Furthermore, they facilitate changing lines or even changing between different types of transport, making it easier to get around [40].

Availability refers to the scope and frequency of PT operations [36]. Tourists consider the punctuality, connectivity, frequency of the service and accessibility to the stop when rating the service [40]. While a low-frequency service is not reliable, a high-frequency service offers the tourist greater flexibility, as they have less knowledge of the service than a local user.

Finally, when it comes to the environmental impact of urban PT, the tram and subway are the greenest in terms of pollution as they run on electricity [41]. By contrast, the majority of buses continue to use internal combustion engines and, even though they are being replaced by hybrids or electric vehicles, their maintenance costs are higher than those of the tramway [42].

## 3. Methodology

We analyzed the topological network of potential trips of tourists from the cruise terminal to the MVMS according to their spatial location. The sequence of proposed trips is: first, from the cruise terminal to the historic center as the main tourist resource, and then from the historic center to each of the MVMs.

### *3.1. Spatial Model of Tourist Resources and Topological Analysis of PT*

The spatial location of the MVMS was performed according to the distance and the type of urban fabric in which they are located. The empirical analysis of the network topology and accessibility of the cruise terminals and MVMs in relation to the historic center was based on the theory of three urban fabrics [13]. This argues that cities (0.5—1 million inhabitants) are a combination of three fabrics based on their transport system: walking, transit/PT and automobile/motor car fabrics. Each fabric has an optimum size depending on the main type of transport, where the central business district (CBD) is a combination of the three transport systems with great social and economic activity (Table 1).

**Table 1.** Nomenclature and extension of the urban fabrics. Source: Authors based on [11].

<table>
<tr><th>Urban Fabric</th><th>Symbol</th><th>Subarea</th><th>Symbol</th><th>Distance (Km)</th></tr>
<tr><td>Walking + Transit + Car</td><td rowspan="3">$W_{UF}$</td><td>Historic center</td><td>HC</td><td>0–0.5</td></tr>
<tr><td rowspan="2">Walking</td><td>Core</td><td>CW</td><td>0–1</td></tr>
<tr><td>Edge</td><td>EW</td><td>1–2</td></tr>
<tr><td rowspan="2">Transit</td><td rowspan="2">$T_{UF}$</td><td>Inner</td><td>IT</td><td>2–8</td></tr>
<tr><td>Outer</td><td>OT</td><td>8–20</td></tr>
<tr><td>Car</td><td>$C_{UF}$</td><td>-</td><td>-</td><td>>20</td></tr>
</table>

Walking urban fabric is the historic city prior to the industrial revolution where differences are made between the most central area or historic center (HC), a denser historic sector (CW) and another more peripheral one (EW). Transit urban fabric is the urban growth of the 19th century and mid-20th century, around the development of tramways/buses (IT) and trains (OT). Finally, the car urban fabric is associated with the large metropolitan peripheral expanse enabled by the development of motorways and highways.

Based on this model, a representation system of concentric rings was used to indicate distance, means of travel and the appeal of the city, where the HC (Figure 1) is the historic center, as it is usually the most attractive urban area with the greatest tourist activity in port cities; and the origin is the most iconic square where the historic town hall is located. The cruise terminal furthest from the historic center was selected. It was represented as a square of proportional size to the annual volume of cruise passengers (Appendix A). The waterfronts are an increasingly important tourist resource for cruise passengers as they are located in close proximity to the cruise terminals.

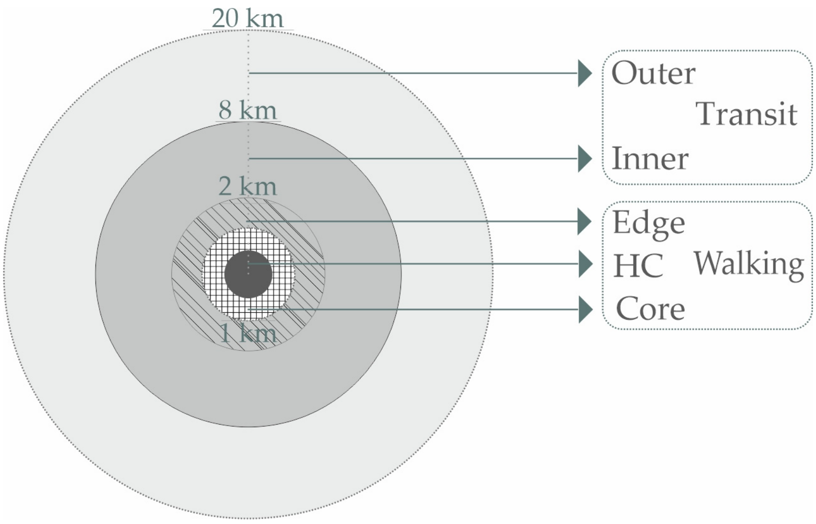



**Figure 1.** Simplified representation model of the three urban fabrics. Source: Authors based on [11].

The MVMs are circles whose diameter is proportional to its appeal, measured by the number of visits per year, and are limited to the first five, given the short time—from 4 to 8 h—that cruise passengers have at the destination [43]. The sources used are described in Appendix B and the Top 20 museums worldwide have been highlighted [44]. A double line was used as the symbol for PT connections and a single line for journeys on foot. The Google Maps platform was used to calculate the distance and time. This method has been used in time and distance studies [45] or when designing vehicle routes [46]. The platform designs a route by setting the origin in the city center and the destination at each MVM or CT. The "transit" mode was selected, and the route options were "best route", "fewest transfers" and "least walking", in order to optimize the total time and distance travel variables. The results covered the values obtained during the summer (22 to 26 July 2018) between 12.00 noon and 1.00 p.m.

### *3.2. Assessment of the Potential Objective Quality of PT Connections*

The purpose of the model was to identify, weight, and value the factors that determine the potential objective quality of the public transport system, which would determine a preference for use by the cruise ship tourist. A transport model can be represented as a mathematical function of variables X and parameters θ, such as: Y = f (X, θ) [47]. An approximation to the value of $Q$ for each PT (bus, subway/tramway, train or ferry) can be expressed as the product of four factors that quantitatively assess the five quality indicators of the PT for tourist use (Table 2), according to Equation (1):

$$Q = F_v\ (F_i\ F_f\ F_e) \tag{1}$$

where $F_v$ is the main variable, and the rest of the factors are parameters so its range is:

$$0 \leq F_i,\ F_f,\ F_e \leq 1$$

Velocity factor ($F_v$). Time is not a variable that affects the quality of the transport but rather a decision by the tourist as to whether to use it to reach the tourist resource. We therefore assessed here the velocity factor ($F_v$) that is defined as the number of times that the average speed of the PT (AV) is higher than the average speed of a person walking (5 km/h). In other words, this variable assesses the speed of PT versus walkability.

Information and payment factor ($F_i$). This rates the web information available on the official transportation website of the city and the availability of tourist travel cards. Its value depends on three variables. The $N_L$ variable expresses the number of languages in which the PT website can be consulted, and its value is limited to four as that is the maximum number found in a prior review of websites. $N_P$ is a dummy variable and indicates that the website has a specific link for tourists [48]; and $N_C$ is related to the existence of travel cards [39], particularly if they facilitate the intermodal use of PT and the access to the museum.

Frequency factor ($F_f$) is used to assess the availability. $F_f$ is inversely proportional to frequency ($F$). $F$ is defined as the time (in minutes) between two stops of the same PT at the same place and the same direction, with an optimum waiting time expected to be 5 min. This value has been taken since the cruise tourist especially values a highly available means of transport given the short time available at the destination.

Environmental impact factor ($F_e$) depends on the PT used: ferry, bus, tram, train, or subway; a value has been given to the Table 2 in relation to their level of pollution, where the train, subway and tram have an advantage over the bus [42].

**Table 2.** Variables and indicators to calculate Q. N.B.L V = variable.

| Indicator | Factor | Formula | V | Description | Value | Data |
|---|---|---|---|---|---|---|
| Information [11,36] | $F_i$—Information & payment factor | $F_i = (N_L + N_P + N_C)/7$ | $N_L$ | Number of languages that the webpage is available (maximum 4) | 1–4 | Appendix C |
| | | | $N_P$ | There is no specific website for tourist passengers [48] | 0 | |
| | | | | There is a specific website for tourist passengers [48] | 1 | |
| Cost and payment method [38–40] | | | $N_C$ | No available intermodal transport ticket | 0 | |
| | | | | Available intermodal transport ticket | 1 | |
| | | | | Available intermodal transport ticket and access museum card | 2 | |
| Time [37,38] | $F_v$—Velocity factor | $F_v = D/5T$ | D | Total distance (km) | - | Google Maps |
| | | | T | Total time (h) | - | |
| Availability [40} | $F_f$—Frequency factor | $F_f = 5/F$ | F | Time (in minutes) between two stops of the same means of transport at the same place and the same direction | - | |
| Environmental impact | $F_e$—Environmental impact factor | | | Bus/ferry [42] | 0.5 | Appendix C |
| | | | | Tram/subway [41] | 1 | |
| | | | | Train [41] | 1 | |

*3.3. Selection of Case Studies*

The selection of cases for the empirical study (Table 3) followed three criteria: two were based on the tourist characteristics (main tourism cruise regions and main cultural destination), and one on the PT infrastructure (population size). Cruise tourism classifies the destinations by different commercial routes and the three main regions are in North America, Europe and Asia [49]. According to CLIA [50], in 2018, North America cornered 50% of the passenger volume (14.34 million) and Europe 25% (7.17 million). The destinations included in the list of world cultural tourism destinations [51] were selected from among them.

The transport infrastructure at the destination is proportional to the size of the population and the degree of economic development. As regards the population size of the metropolitan area (Appendix A), the study differentiated between small destinations (0.5 and 1 million inhabitants); medium destinations (1 and 3 million inhabitants), which includes state capitals; and large destinations (over 3 million inhabitants), which includes Hong Kong, a special benchmark as it is the destination with the largest number of tourists worldwide and with a highly developed PT system [52].

**Table 3.** Selection of cities to be studied and 2018 figures. P = Population of the municipality in million (Appendix A), PM = Population of the metropolitan area in million (Appendix A), Tc = Annual volume of cruise passengers (Appendix A), T = Total Tourists per year [48], $M_{20}$ = Number of museums included in Top 20 [42].

| Cruise Routes | City | Country | P | $P_M$ | Type | T | $T_c$ | $T_c/T$ (%) | $M_{20}$ |
|---|---|---|---|---|---|---|---|---|---|
| Asia & China | Hong Kong | China | 7.5 | 7.5 | Large | 29.8 | 700,000 | 2.3 | - |
| Northern Europe | Amsterdam | Netherlands | 0.7 | 2.0 | Medium | 8.5 | 425,000 | 5.0 | 2 |
| Central & Western Mediterranean | Venice | Italy | 0.3 | 0.9 | Small | 5.4 | 1,580,000 | 29.3 | - |
| Central & Western Mediterranean | Lisbon | Portugal | 0.6 | 2.9 | Medium | 3.8 | 515,514 | 13.6 | - |
| Canada/New England | Vancouver | Canada | 0.6 | 2.6 | Medium | 3.2 | 889,000 | 27.8 | - |
| Northern Europe | Copenhagen | Denmark | 0.6 | 1.7 | Medium | 3.0 | 865,000 | 28.8 | - |
| Western coast of North-America/Mexico/ California/Pacific Coast | San Francisco | USA | 0.8 | 7.2 | Large | 3.0 | 300,000 | 10.0 | 1 |
| Baltics | Stockholm | Sweden | 0.8 | 1.8 | Medium | 2.6 | 623,000 | 20.7 | - |
| Canada/New England | Quebec | Canada | 0.5 | 0.8 | Small | 2.9 | 200,000 | 6.9 | - |
| Central & Western Mediterranean | Malaga | Spain | 0.6 | 0.9 | Small | 2.3 | 505,633 | 22.0 | - |

## 4. Results

### *4.1. Relevance of the Cruise Activity in the Case Studies*

The number of cruise tourists ($T_C$) mean that the relevance of their activity at the destination can be determined in relation to the total number of tourists ($T_C/T$). Hong Kong is the destination with the largest number of tourists (and also worldwide), followed by Amsterdam and Venice (Table 3). However, the relevance of cruise tourism in Hong Kong is very low (2.3%), rather higher in Amsterdam (5%), while the most important destinations (>20%) are Malaga, Stockholm, Copenhagen, Vancouver, and particularly Venice (29.3%). The relevance of tourist activity, in relation to the world population both of the total tourists (T/P) and the cruise tourists ($T_C/P$), indicates an initial estimate of the potential pressure that tourists may exercise on the PT and the MVMs (Figure 2). The greatest global indexes are in Venice and Amsterdam, and on a second level Lisbon, Vancouver, Quebec, and Copenhagen. However, the greatest cruise pressure occurs, by far, in Venice (Level A > 2) and on a second level Vancouver, Malaga, Quebec and Copenhagen (1< Level B ≤ 2), while the relevance of the other cities is low (Level C ≤ 1).

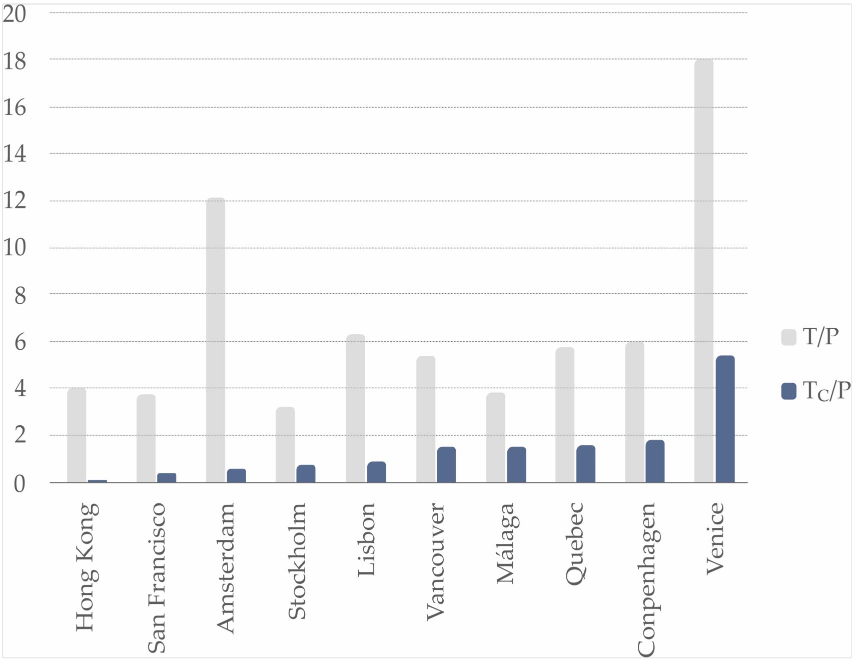



**Figure 2.** Relevance of global tourist activity in relation to the municipal population (T/P) and relevance of cruise activity in relation to the municipal population ($T_C$/P) in 2018. Source: authors.

*4.2. Degree of Spatial Centrality*

The degree of spatial centrality qualifies the proximity of the MVMs to the historic center as a more attractive area. In this study, the centrality facilitates the soft mobility and less frequent use of public transport. The results indicated five levels of centrality, with the first level the most centralized and the fifth the most decentralized (Table 4).

**Table 4.** Data for the quality of connections for MVMs and CT. Note: R = museum ranking; (*) M20's museum.

| City (Origin Point) | Museum/CT | Subarea | V (2017) | R | Means of Transport | $N_L$ | $N_C$ | $N_P$ | $F_i$ | D (km) | T (h) | AV (km/h) | $F_v$ | $F_f$ | $F_e$ | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Venice (St. Mark's) | Cruise Terminal Venice (CT) | - | - | - | Ferry | 2 | 1 | 1 | 4/7 | 2.9 | 0.57 | 5.80 | 1.02 | 0.17 | 0.5 | 0.05 |
| | Palazzo Ducale | HC | 1,405,440 | 1 | Walking | - | - | - | - | 0.3 | 0.07 | 4.50 | - | - | - | - |
| | Peggy Guggenheim Collection | CW | 427,209 | 2 | Ferry | 2 | 1 | 1 | 4/7 | 1.0 | 0.20 | 5.00 | 1.00 | 0.42 | 0.5 | 0.12 |
| | Correr Museum | HC | 334,820 | 3 | Walking | - | - | - | - | 0.1 | 0.04 | 3.90 | - | - | - | - |
| | Galleria dell'Academia | EW | 316,995 | 4 | Walking | - | - | - | - | 1.1 | 0.23 | 4.72 | - | - | - | - |
| | Ca'Rezzonico | EW | 101,640 | 5 | Ferry | 4 | 2 | 1 | 7/7 | 1.2 | 0.20 | 6.00 | 1.20 | 0.08 | 0.5 | 0.05 |
| Malaga (Constitution Square) | Cruise Terminal B (CT) | - | - | - | Walking | - | - | - | - | 2.5 | 0.51 | 4.84 | - | - | - | - |
| | Picasso Museum | HC | 635,891 | 1 | Walking | - | - | - | - | 0.4 | 0.08 | 4.80 | - | - | - | - |
| | CAC | EW | 505,022 | 2 | Walking | - | - | - | - | 1.1 | 0.22 | 5.08 | - | - | - | - |
| | Pompidou Museum | EW | 168,143 | 3 | Walking | - | - | - | - | 1.1 | 0.23 | 4.71 | - | - | - | - |
| | Thyssen Museum | HC | 157,948 | 4 | Walking | - | - | - | - | 0.1 | 0.03 | 3.00 | - | - | - | - |
| | Russian Museum | IT | 116,897 | 5 | Bus | 2 | 0 | 0 | 2/7 | 3.1 | 0.58 | 5.31 | 1.02 | 0.40 | 0.5 | 0.06 |
| Quebec (City Hall) | Quay Terminal 30 (CT) | - | - | - | Walking | - | - | - | - | 1.2 | 0.25 | 4.80 | - | - | - | - |
| | Museum of Civilization | CW | 559,179 | 1 | Walking | - | - | - | - | 0.8 | 0.17 | 4.80 | - | - | - | - |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | National Museum of Arts | IT | 444,047 | 2 | Bus | 3 | 1 | 0 | 4/7 | 2.1 | 0.22 | 9.69 | 1.94 | 0.35 | 0.5 | 0.19 |
| | La Place-Royale Museum | CW | 84,708 | 3 | Walking | - | - | - | - | 0.6 | 0.12 | 5.14 | - | - | - | - |
| | L'Amérique Francophone Museum | HC | 60,221 | 4 | Walking | - | - | - | - | 0.1 | 0.03 | 3.00 | - | - | - | - |
| | Maison Historique Chevalier | CW | 27,052 | 5 | Walking | - | - | - | - | 0.6 | 0.13 | 4.50 | - | - | - | - |
| Copenhagen (Rådhuspladsen) | Quay Terminal 3 (CT) | - | - | - | Tram/Subway | 3 | 1 | 0 | 4/7 | 7.8 | 0.62 | 12.65 | 2.53 | 0.25 | 1 | 0.36 |
| | Louisiana Museum for Moderne Kunst | CUF | 657,293 | 1 | Train | 3 | 2 | 0 | 5/7 | 36 | 0.82 | 44.08 | 8.82 | 0.25 | 1 | 1.58 |
| | Christiansborg Slot | EW | 431,536 | 2 | Walking | - | - | - | - | 1.5 | 0.30 | 5.00 | - | - | - | - |
| | Ny Calsberg Glyptotek | CW | 410,160 | 3 | Walking | - | - | - | - | 0.8 | 0.15 | 5.33 | - | - | - | - |
| | National Museum of Denmark | CW | 351,373 | 4 | Walking | - | - | - | - | 1.0 | 0.20 | 5.00 | - | - | - | - |
| | Kongernes Samling | EW | 534,361 | 5 | Walking | - | - | - | - | 1.3 | 0.27 | 4.88 | - | - | - | - |
| Stockholm (Stortoget) | Stockholm Cruise Center (CT) | - | - | - | Bus | 2 | 1 | 1 | 4/7 | 4.5 | 0.40 | 11.25 | 2.25 | 0.42 | 0.5 | 0.27 |
| | Vasamuseet | IT | 1,496,000 | 1 | Bus | 2 | 1 | 1 | 4/7 | 2.5 | 0.28 | 8.83 | 1.76 | 0.33 | 0.5 | 0.17 |
| | Skansen Museum | IT | 1,342,763 | 2 | Tram/Subway | 2 | 1 | 1 | 4/7 | 2.7 | 0.42 | 6.48 | 1.30 | 0.50 | 1 | 0.37 |
| | Naturhistoriska | IT | 648,000 | 3 | Bus | 2 | 1 | 1 | 4/7 | 5.4 | 0.38 | 14.09 | 2.82 | 1 | 0.5 | 0.80 |
| | ArkDes | EW | 581,383 | 4 | Walking | - | - | - | - | 1.7 | 0.33 | 5.10 | - | - | - | - |
| | Moderna museet | EW | 581,383 | 5 | Walking | - | - | - | - | 1.5 | 0.30 | 5.00 | - | - | - | - |
| Amsterdam (Dam Square) | Cruise Ship Passenger (CT) | - | - | - | Tram/Subway | 2 | 2 | 1 | 5/7 | 2.4 | 0.27 | 9.00 | 1.80 | 0.50 | 1 | 0.64 |
| | Van Gogh Museum (*) | IT | 2,260,000 | 1 | Tram/Subway | 2 | 2 | 1 | 5/7 | 2.2 | 0.23 | 9.44 | 1.89 | 1.25 | 1 | 1.68 |
| | Rijksmuseum (*) | EW | 2,160,000 | 2 | Tram/Subway | 2 | 2 | 1 | 5/7 | 1.7 | 0.18 | 9.29 | 1.85 | 0.50 | 1 | 0.66 |
| | Anna Frank House | CW | 1,266,966 | 3 | Tram/Subway | 2 | 2 | 1 | 5/7 | 0.8 | 0.13 | 6.02 | 1.20 | 0.71 | 1 | 0.61 |
| | Stedelijk Museum | IT | 691,851 | 4 | Tram/Subway | 2 | 2 | 1 | 5/7 | 2.3 | 0.25 | 9.20 | 1.84 | 1.25 | 1 | 1.64 |
| | Rembrandt Museum | CW | 265,000 | 5 | Walking | - | - | - | - | 0.7 | 0.13 | 5.38 | - | - | - | - |
| Vancouver (Robson) | Canada Place (CT) | - | - | - | Bus | 1 | 1 | 0 | 2/7 | 0.9 | 0.15 | 6.00 | 1.20 | 0.17 | 0.5 | 0.03 |
| | Science World | IT | 749,790 | 1 | Bus | 1 | 1 | 0 | 2/7 | 2.2 | 0.33 | 6,61 | 1.32 | 0.42 | 1 | 0.08 |
| | Vancouver Art Gallery | HC | 601,242 | 2 | Walking | - | - | - | - | 0.0 | 0.02 | 0.00 | - | - | - | - |
| | Museum of Anthropology | OT | 200,559 | 3 | Bus | 1 | 1 | 0 | 2/7 | 18.5 | 0.75 | 24.68 | 4.94 | 0.17 | 0.5 | 0.12 |
| | HR MacMillan Space Center | IT | 125,587 | 4 | Bus | 1 | 1 | 0 | 2/7 | 2.7 | 0.35 | 7.71 | 1.54 | 0.17 | 0.5 | 0.04 |
| | Vancouver Maritime Museum | IT | 65,058 | 5 | Bus | 1 | 1 | 0 | 2/7 | 2.9 | 0.35 | 8.29 | 1.66 | 0.17 | 0.5 | 0.04 |
| San Francisco (Union Square) | James R. Herman (CT) | - | - | - | Bus | 4 | 1 | 1 | 6/7 | 2.7 | 0.62 | 7.83 | 0.89 | 0.25 | 0.5 | 0.10 |
| | California Academy of Science (*) | IT | 1,160,000 | 1 | Bus | 4 | 1 | 1 | 6/7 | 6.1 | 0.47 | 13.13 | 2.62 | 0.17 | 0.5 | 0.19 |
| | San Francisco Museum Modern Art | CW | 1,113,984 | 2 | Walking | - | - | - | - | 0.8 | 0.17 | 4.80 | - | - | - | - |
| | De Young | IT | 994,000 | 3 | Bus | 4 | 1 | 1 | 6/7 | 6.3 | 0.67 | 9.41 | 1.88 | 0.17 | 0.5 | 0.13 |
| | Exploratorium | IT | 849,702 | 4 | Bus | 4 | 1 | 1 | 6/7 | 2.4 | 0.32 | 7.61 | 1.52 | 0.25 | 0.5 | 0.16 |
| | Legion of Honor | OT | 475,000 | 5 | Bus | 4 | 1 | 1 | 6/7 | 8.6 | 0.68 | 12.64 | 2.54 | 0.17 | 0.5 | 0.18 |
| Lisbon (Marquet) | Lisbon Cruise Port Jardim (CT) | - | - | - | Tram/Subway | 2 | 1 | 0 | 3/7 | 1.2 | 0.18 | 6.55 | 1.31 | 0.42 | 1 | 0.23 |

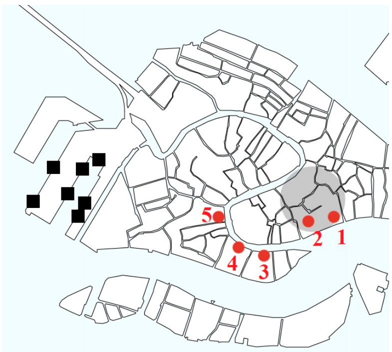
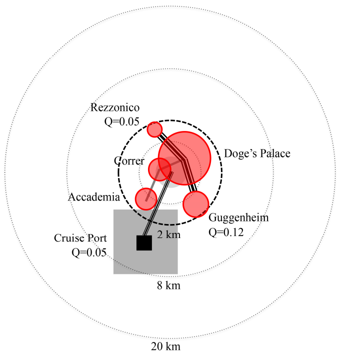
| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Berardo Collection Museum | IT | 1,006,145 | 1 | Tram/Subway | 2 | 1 | 0 | 3/7 | 6.7 | 0.50 | 13.40 | 2.68 | 0.42 | 1 | 0.48 |
| | National Museum of Cars | IT | 350,254 | 2 | Tram/Subway | 2 | 1 | 0 | 3/7 | 5.7 | 0.43 | 13.68 | 2.63 | 0.42 | 1 | 0.47 |
| | National Museum of Ancient Art | IT | 212,669 | 3 | Bus | 2 | 1 | 0 | 3/7 | 2.4 | 0.23 | 10.28 | 2.06 | 0.33 | 0.5 | 0.15 |
| | National Museum of Tiles | IT | 193,444 | 4 | Bus | 2 | 1 | 0 | 3/7 | 2.9 | 0.25 | 11.60 | 2.32 | 0.83 | 0.5 | 0.41 |
| | National Museum of Archaeology | IT | 167,634 | 5 | Tram/Subway | 2 | 1 | 0 | 3/7 | 6.6 | 0.50 | 14.67 | 2.64 | 0.42 | 1 | 0.47 |
| Hong Kong (Statue Square) | Ocean Terminal (CT) | - | - | - | Tram/Subway | 2 | 1 | 1 | 4/7 | 2.2 | 0.27 | 4.89 | 1.65 | 2.50 | 1 | 2.36 |
| | Hong Kong Science Museum | IT | 2,016,553 | 1 | Tram/Subway | 2 | 1 | 1 | 4/7 | 3.2 | 0.33 | 9.60 | 1.92 | 1.25 | 1 | 1.37 |
| | Museum of History | IT | 1,491,899 | 2 | Tram/Subway | 2 | 1 | 1 | 4/7 | 3.2 | 0.30 | 9.60 | 2.13 | 1.25 | 1 | 1.52 |
| | Hong Kong Heritage Museum | OT | 1,142,235 | 3 | Bus | 3 | 1 | 1 | 5/7 | 15 | 0.67 | 22.50 | 4.50 | 0.33 | 0.5 | 0.54 |
| | Hong Kong Space Museum | IT | 432,394 | 4 | Tram/Subway | 2 | 1 | 1 | 4/7 | 2.2 | 0.28 | 7.33 | 1.55 | 1.25 | 1 | 1.11 |
| | Hong Kong Railway Museum | $C_{UF}$ | 295,479 | 5 | Bus | 3 | 1 | 1 | 5/7 | 25 | 0.88 | 30.00 | 5.66 | 0.33 | 0.5 | 0.67 |

In the centralized model (Table 5), the MVMs and the cruise terminals are located in the historic city or walking urban fabric ($W_{UF}$), and most passengers can potentially travel on foot and the main PT are bus and ferry. We can differentiate between two levels:

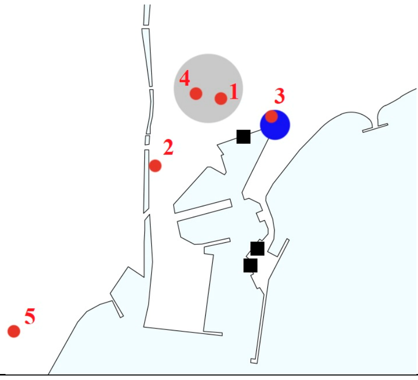
Level 1 or centralized, if all the MVMs are located at the historic city ($W_{UF}$), this makes it easier to get around on foot with the support of PT without high Q levels, as is the case of Venice.

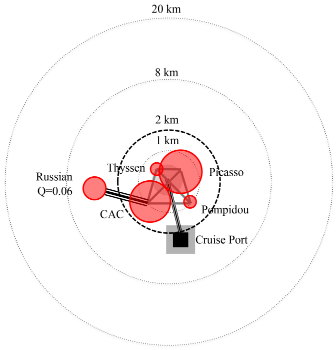
Level 2 or concentrated, if the majority of the MVMs are located at the historic city ($W_{UF}$) and have transit urban/car fabric ($T_{UF}$/$C_{UF}$) resources. Q depends on the development level of the transport system. In the case of the MVMs located at Inner Transit (all in small cities), the connection is by bus and the Q value is low (Malaga and Quebec), while access to the car fabric ($C_{UF}$) in medium cities (Copenhagen) is by train with a high Q value.

**Table 5.** Cities with centralized structure (Levels 1 and 2).

| R | City | Level—Main PT ($Q_{min}$ – $Q_{max}$)/Q (CT) |
|---|---|---|
| 1. Doge's Palace (HC)<br>2. Peggy Guggenheim Collection (CW)<br>3. Correr Museum (HC)<br>4. Academia (EW)<br>5. Ca'Rezzonico (EW) | Venice<br><br> | Level 1—Ferry (0.05–0.12)/0.05<br><br> |
| | Malaga | Level 2—Bus (0.06)/- |

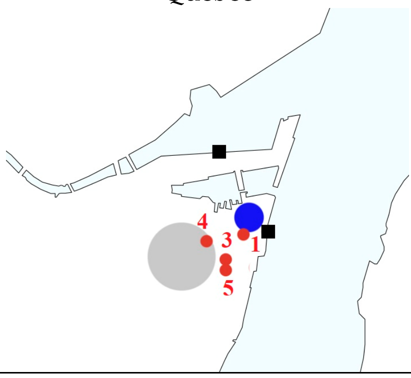
1. Picasso (HC)
2. CAC (EW)
3. Pompidou (EW)
4. Thyssen (CH)
5. Russian (IT)

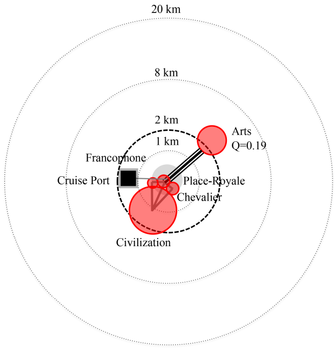



Quebec | Level 2—Bus (0.19)/-

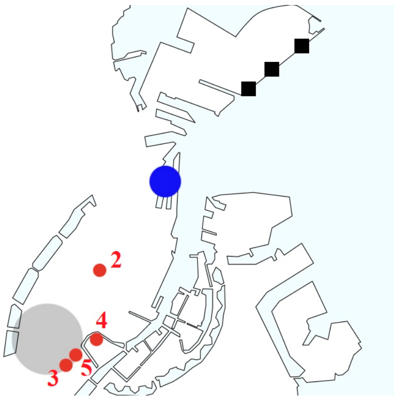
1. Civilization (CW)
2. Arts (IT)
3. La Place Royale (CW)
4. L'Amérique Franco-phone (HC)
5. Maison Historique Chevalier (CW)

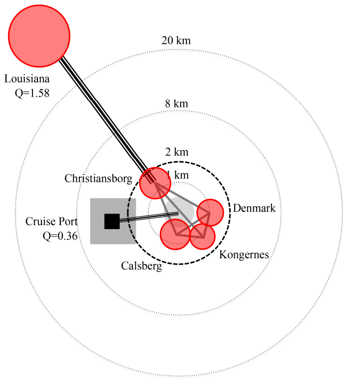



Copenhagen | Level 2—Train (1.58)/0.38

1. Lousiana (CUF)
2. Christiansborg Slot (EW)
3. Ny Calsberg Glyptotek (CW)
4. Denmark (CW)
5. Kongernes Samling (EW)



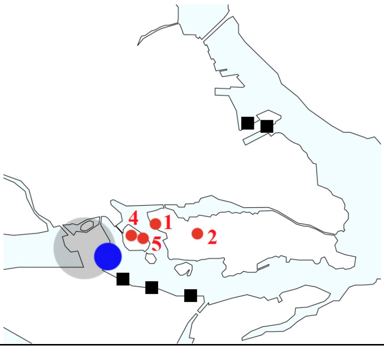
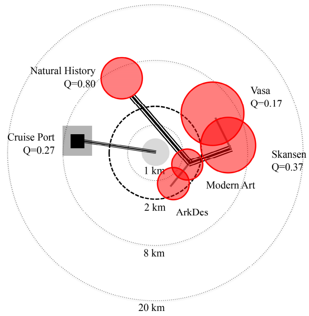
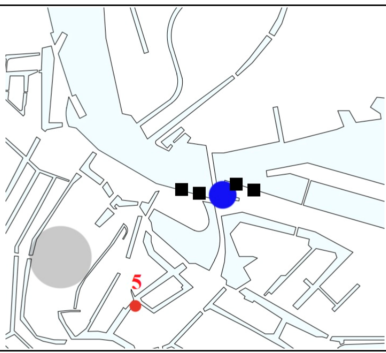
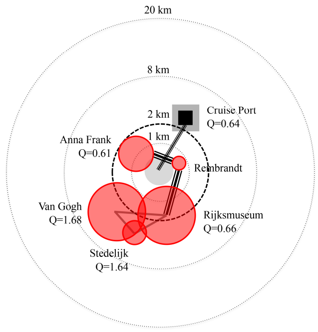
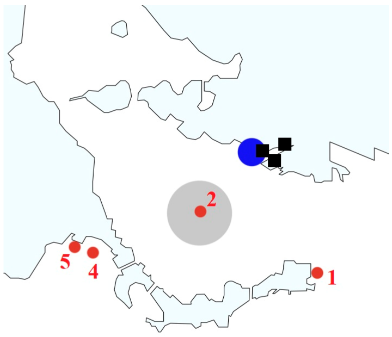
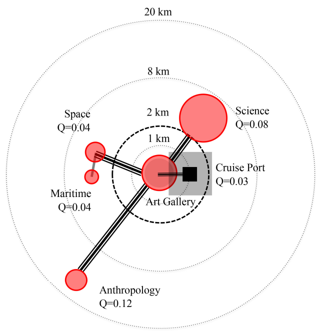
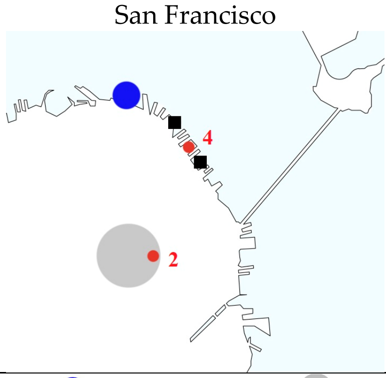
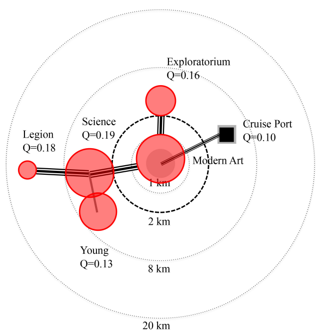

MVM Waterfront HC CT PT Walking

In the decentralized model (Tables 6 and 7), the MVMs are located mainly within the transit urban fabric (TUF), which implies greater use of PT compared to getting around on foot. Bus and tram/subway are most used. We can differentiate between three levels:

Level 3 or peripheral, the MVMs are no longer in the historic city, but in the first peripheral of the historic city (EW) and in the first periphery (IT) of the transit urban fabric (TUF), within a range of between 1 and 8 km with acceptable Q values in medium cities (Stockholm and Amsterdam) supported by a subway transport system.

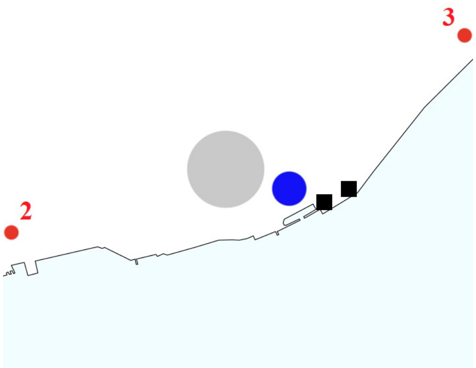
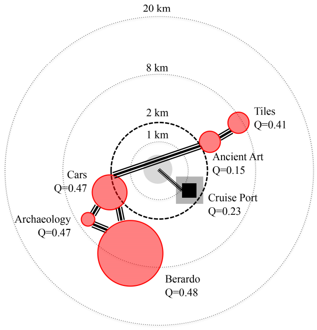
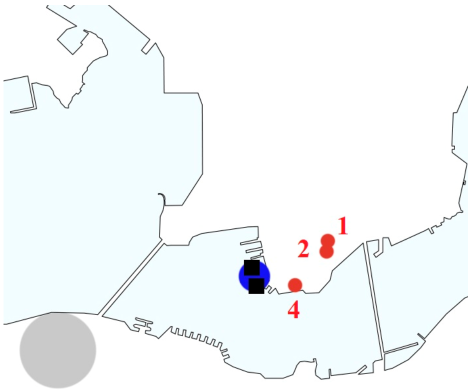
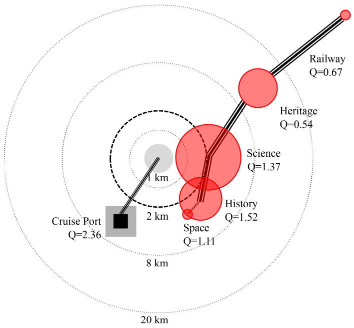
Level 4 or mixed, the majority of the MVMs are located in the transit urban fabric, both in the internal (IT) and external territory (OT), with the specific feature of having an MVM in the historic center (WUF), while the PT connections are by bus with low Q values and occur both in medium (Vancouver) and large cities (San Francisco).

**Table 6.** Cities with decentralized structure (Levels 3 and 4).

| R | City | Level—Main PT ($Q_{min}$ − $Q_{max}$)/Q (CT) |
|---|---|---|
| | Stockholm | Level 3—Bus/sub (0.17–0.80)/0.27 |
| 1. Vasamuseet (IT)<br>2. Skansen (IT)<br>3. Naturhistoriska (IT)<br>4. ArkDes (EW)<br>5. Moderna museet (EW) |  |  |
| | Amsterdam | Level 3—Sub (0.61–1.68)/0.64 |
| 1. Van Gogh (IT)<br>2. Rijksmuseum (EW)<br>3. Anna Frank House (CW)<br>4. Stedelijk (IT)<br>5. Rembrandt (CW) |  |  |
| | Vancouver | Level 4—Bus (0.04–0.12)/0.03 |
| 1. Science World (IT)<br>2. Vancouver Art Gallery (HC)<br>3. Anthropology (OT)<br>4. HR MacMillan Space Center (IT)<br>5. Vancouver Maritime (IT) |  |  |
| | San Francisco | Level 4—Bus (0.13–0.16)/0.10 |
| 1. California Academy of Science (IT)<br>2. San Francisco Museum Modern Arts (CW)<br>3. De Young (IT)<br>4. Exploratorium (IT)<br>5. Legion of Honor (OT) |  |  |
| ● MVM | ● Waterfront ● HC ■ CT | PT Walking |

Level 5 or external, the MVMs are located outside the walking urban fabric ($W_{UF}$), in the peripheral area or in the external area, with a territorial distribution supported by greater use of the subway/tram and Q levels proportional to the type of city: large cities as Hong Kong (0.54–1.52) or medium cities as Lisbon (0.15–0.48).

**Table 7.** Cities with decentralized structure (Level 5).

| R | City | Level—Main PT ($Q_{min}$–$Q_{max}$)/Q (CT) |
|---|---|---|
| 1. Berardo Collection (IT)<br>2. National Museum of Cars (IT)<br>3. National Museum of Ancient Art (IT)<br>4. National Museum of Tiles (IT)<br>5. National Museum of Archaeology (IT) | Lisbon<br> | Bus/Tram (0.15–0.48)/0.23<br> |
| 1. Hong Kong Science (IT)<br>2. History (IT)<br>3. Hong Kong Heritage (OT)<br>4. Hong Kong Space (IT)<br>5. Hong Kong Railway (CUF) | Hong Kong<br> | Bus/ Sub (0.54–1.52)/2.36<br> |
| MVM Waterfront | HC CT | PT Walking |

### 4.3. Accessibility and Potential Quality of Transport Systems

Regarding MVMs, a direct relationship between the number of the MVM visitors and the Q value can be seen in the centralized and decentralized models. In the centralized model, the results show no correlation between distance to the center and number of visitors; on the contrary, Q does have a meaningful effect on the popularity of the museums (Table 4). Therefore, the Russian Museum (Malaga) and the National Museum of Arts (Quebec) are accessed by bus, but in the first case, it has the worst objective quality (Q = 0.06) and 116,897 visitors, while the connection in the second is Q = 0.19 and quadruples the number of visitors (444,047 visitors). Additionally, the connection between Copenhagen and the Louisiana Museum is by train, which covers the 49 km in 50 min, and its high level of objective quality (Q = 1.58) is also met with a high number of visitors (657,293).

In the decentralized model, almost all museums in Level 5 present a high Q, although, in this case, it does not correlate with a higher number of visitors, as was observed in the centralized model (see the case of Hong Kong's "Railway Museum"). Museums in Lisbon are located at a considerable distance from the historic center, but this factor does not reduce their popularity due to the great infrastructure available by means of trams that travel at an Q of ~ 0.45. These connections assure that every trip takes less than 30 min. Nevertheless, with comparable Q, the Berardo Collection Museum has a significantly higher number of visitors. Even the lowest Q museum with a bus connection (the National Museum of Ancient Art, Q = 0.15) displays a comparable number of visitors to museums connected by tram. A similar behavior is repeated in Hong Kong, with the Hong Kong Heritage Museum and the Hong Kong Railway Museum, which are located, respectively, 15 and 25 km away from the city center; the factor of velocity ($F_V$) of these connections is adequate, carrying out the trip at an $F_V$ of 4.5 and 5.66 by subway.

Regarding cruise terminals, most of them are located within a range of 3 km to the historic centers, except for Copenhagen and Stockholm. This proximity allows a tourist draw area to be generated, which is boosted by waterfronts with businesses and even MVMs. The cruise terminals (Venice) and the waterfront (Malaga, Quebec) are part of or adjacent to the historic center in the more centralized models and small cities. There are mainly pedestrian destinations where the trip from the cruise terminal to the center and museums can be on foot and in under 1 h, even though it should be noted that the tourist usually strolls along, enjoying the surroundings or stopping to shop, and the time can therefore be longer. In the decentralized models, the cruise terminals are close to the waterfront or very close to the historic center (e.g., Stockholm or Lisbon). These are destinations where the cruise terminal is connected by PT with the center—in a time of roughly or under 30 min—and from which the tourist can move around in three ways: (a) potentially on foot as is the case of Copenhagen; (b) walking and on PT (Stockholm); and (c) fundamentally on PT (Amsterdam, Vancouver, San Francisco, Lisbon, and Hong Kong).

## 5. Discussion

The potential quality study allows valuable trends and defects to be found among PT systems. Although this paper analyzed MVM interconnections, the proposed methodology could be applied to any PT connection between any tourist draw, and it permits comparisons between different PT services—in relation with tourism—in a simple and quick manner. In contrast with other quality studies that gave an average value to the quality of the whole PT system in the tourist destination [10,33,48,53], this study was specific in the assessment of every connection or line, which led to greater accuracy in the results compared to more generic conclusions such as those defined by [54].

As regards the distribution and relation of the MVMs to the historic center, this study offers new results from the perspective of the cruise tourist companies compared to studies that show a centralized distribution from a territorial analysis perspective [5,22]. The results showed two organization levels: (a) a concentration gradient of the MVMs around the appeal of the historic center with a different degree of centralization/decentralization, where there is a great potential to travel on foot or by PT; and (b) greater or fewer number of MVM clusters that are internally conducive to getting around on foot and have good PT connections to other clusters or areas, which conforms to the tendency of museums to agglomerate [5].

As regards the factors that affect the potential use of soft mobility and PT, Table 8 compares the size of the destination, the centralization level (Q), the relevance of the destination, the proximity of the cruise terminal to the historic center and the appeal of the central museums ($PW_{UF}$). This last indicator, defined as the relationship between the visitors of the MVMs within the historic center ($W_{UF}$) and the total tourists of destination T, will indicate the global appeal for the tourist of the historic center in relation to the rest of the city. Based on these variables, the results of the case studies are a casuistry within a gradient between the two extreme cases: Venice as a destination that fosters the potential use of soft mobility and Hong Kong as a destination for the potential use of PT.

**Table 8.** Factors that affect the potential use of soft mobility and PT to access the MVMs and the historic center. The upper level shows those closest linked to soft Mobility and the lower level those closest linked to PT. N.B.: CL = Centralization Level, $T_C/P$ = Relevance of the cruise activity; DCT = Distance from cruise terminal to the historic center; $PW_{UF}$ = Appeal of central museums.

| Destination | Size | CL | PT (Q min—Q max) | $T_C$/P | $D_{CT}$ (km) | $PW_{UF}$ (%) |
|---|---|---|---|---|---|---|
| Venice | Small | N1 | Ferry (0.10–0.24) | A | 2.9 | 68.60 |
| Malaga | Small | N2 | Bus (0.06) | B | 2.5 | 63.78 |
| Quebec | Small | N2 | Bus (0.19) / - | B | 1.2 | 25.21 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Copenhagen | Medium | N2 | Train (1.58) | B | 7.8 | 52.52 |
| Stockholm | Medium | N3 | Bus/sub (0.17–0.80) | C | 0.9 | 55.77 |
| Amsterdam | Medium | N3 | Sub (0.61–1.68) | C | 2.4 | 43.10 |
| San Francisco | Large | N4 | Bus (0.13–0.16) | C | 2.7 | 37.13 |
| Vancouver | Medium | N4 | Bus (0.04–0.12) | B | 0.9 | 18.75 |
| Lisbon | Medium | N5 | Bus/Tram (0.15–0.48) | C | 1.2 | - |
| Hong Kong | Large | N5 | Bus/Sub (0.54–1.52) | C | 2.2 | - |

Venice is a European cruise tourism destination with a historic center with a high museum appeal in the center ($PW_{UF} = 68.60$), where all the MVMs are concentrated, making it a very attractive destination for cruise tourists as it offers many advantages: short journeys (on foot or by ferry), a high landscape value, and the ease of visiting the most appealing museums. This concentration and centralization do not require large transport infrastructure for cruise tourists to move around. However, this does lead to an "encapsulation" and segregation of the most attractive museums, compared to the rest of the city. This is a functional formula that fosters sustainable mobility on foot or soft mobility for cruise tourists, but which potentially generates a territorial disbalance of the MVMs, as the resident population must travel to the historic center to visit the MVMs, a situation opposite to the territorial balance of residents in access to museums reported in Helsinki [21].

In Venice and in small cities, the MVMs form a cluster in the historic center, where the short distances and, in many cases, the pedestrian-only areas, encourage journeys on foot and non-motorized means of transport (bicycles or e-bicycles) [19]. For example, the bicycle is the main means of transport in Copenhagen [55]. This makes the historic centers hotspots of activity. Nevertheless, this can still lead to congestion issues in the center of the city, in addition to other social problems derived from tourist activities [56,57].

The Venice model, which is replicated in small cities (Málaga, Quebec) and some medium-sized cities such as Copenhagen and even Stockholm, has a cluster of MVMs in the historic center, which is very attractive to cruise tourists; so, alternatives to visiting more peripheral museums require high levels of Q. For example, the Louisiana Museum for Moderne Kunst (Copenhagen) is accessible by train and has an intermodal transport ticket and access museum card, which explains the significant influence between Q and the number of tourists located out of the historic center. This formula has been assumed by Amsterdam where all its MVMs have access by tram/subway and an intermodal transport ticket with access museum card, a very attractive model for tourists, but not for cruise ship tourists.

Hong Kong is a highly decentralized Asian tourist destination with a rather unattractive historic center. The main world cultural destination is of very little importance in cruise activity. Its decentralized MVM distribution model in the territory is supported by a PT subway/train system with high Q levels. This has created a more balanced accessibility of the resident population to the museums and greater potential interactions between the tourist and resident. Yet it has also required a greater effort for the authorities that manage transport in Hong Kong to maintain the quality of transport and use by the tourist.

In Hong Kong and in cities with developed PT (medium and large ones), there is a greater mobility and territorial accessibility between the historic center, the MVMs, and the cruise terminal. Amsterdam and Hong Kong, with effective and extensive PT networks, are more attractive to tourists [11] but less attractive to cruise ship tourists due to reduced $T_c/P$ levels. The historic center loses its centrality status due to the development of other clusters that are well connected to the PT. The results in a decentralized model showing the existence of clusters, in other words, museum areas around two or three MVMs, which are connected by pedestrian-only areas. It clearly occurs in Level 3 to 5 destinations. This allows a broader distribution of the tourist resources and, therefore, the tourists make their decisions not only based on Q, but mainly on their interest to visit a specific tourist draw.

## 6. Conclusions

The correlation between cruise ship tourists and the centrality of museums in the historic center seems to indicate a greater preference for the model that promotes soft mobility, this is explained by the proximity of these resources to the nautical station [14]. Conversely, decentralized models are associated with a lower percentage of cruise tourists, since they require more time to visit museums. The analyzed models are tendential and potential, given that the travel hypothesis studied (cruise terminal/waterfront, historic center and MVM) are theoretical, as the real movement of cruise tourists at the destinations is unknown. However, the results obtained can help new museum policies in terms of their accessibility and spatial distribution, not only in relation to cruise tourists, but also to the tourist challenge and to the metropolitan or local residents of the destinations.

### *6.1. Measures to Improve the Cruise Terminal*

Turning the cruise terminal into a transport hub would facilitate the accessibility of cruise tourists to the historic center and the MVMs, but it would require a hefty economic investment. This study suggests other more affordable measures:

- Improving information to cruise tourists. Most of the PT websites consulted are at least in the native language and English ($N_L = 2$) and with a specific section for tourists ($N_P = 1$). However, there is a total lack of "intermodal transport ticket and access museum card". The option of buying that combined ticket online is recommended so that cruise tourists do not have to exchange money and physically purchase the ticket. This would increase the $F_i$ indicator by 30%. It is a measure implemented in Amsterdam and associated with museums with a high number of peripheral visitors to the historic centers. If that were not possible, greater information on the use of PT at the destination should be available at the cruise terminal and it should be easier to purchase public transport and tourist tickets by e-payments;
- Improving connection between the cruise terminal and historic center or transport station. The cruise terminal should be connected to the historic center (in the centralized model) or with a subway/bus station (in the decentralized model) by electric or zero-emission bus (at least during the cruise high season) or shared bike/e-bikes. Shared e-bikes would facilitate their use among older people, which could improve the indicator to $F_e = 1$ and that would double the Q value. This measure coincides with the strategies developed by an urban system of soft mobility pathways for pedestrians and bicycles to connect the historic center with the waterfront [58].

### *6.2. Measures to Improve the Objective Quality of PT*

As centralized models are more prone to developing soft mobility policies, the development of a decentralized system requires a quality transport system. Given that the centralized systems can end up overwhelmed with a large increase of tourists, projects such as Tourism Friendly Cities [59] have proposed a balance between a local community's needs and the promotion of a more sustainable tourist development, which implies a reduction in the number of visitors to historic centers. Thus, the optimum growth would be a decentralized cluster model (pedestrianized areas of MVMs or other resources) that is well-connected by a high-quality train, tram or subway transport system. The improvement of Q can be introduced by a shift to a new means of transport, e.g., replacing a bus by a tram would improve Q by over 30%, without taking into consideration the increase in average velocity, which would improve it even further. However, building new subway infrastructures requires major investments and is only justified if it serves an area with sufficient population density and nearby amenities. Other more affordable alternatives arising from this study can be put forward:

- Creating new museums, both close to the urban waterfront or to transport stations. The development of new museums in the urban waterfronts near to the cruise terminal, as is the case in Malaga, Quebec, San Francisco and Hong Kong, that have museums or floating museums (historic ships). Establishing new museums in subway or train stations (or very close to them) would facilitate them being visited by cruise tourists as they are places with great urban accessibility, as would setting up new museum clusters near to existing subway lines, e.g., scientific museums near to universities with subway stops, such is the case of Hong Kong;
- Analyzing the feasibility of conventional means of transport fostering the tourist experience particularly associated to the tram, train (the existence of many abandoned tracks near to the ports should be noted). Similar to the proposal for the reuse of disused railway lines for pedestrian and cycle path developed in proposals for sustainable mobility in urban waterfronts [18]. Or, following Venice's example, creating ferry or small tourist boat lines running between the cruise terminal and waterfront heritage resources or museums would allow cruise passengers to discover the city and explore outside the historic center. In this regard, some authors [60] have concluded that the development of a ferry line as a formula for public transport in port areas increases the accessibility of the neighborhoods it connects.

This study also has several limitations. It does not take into account the incidence of taxis [61]. Tourists are very likely to return by taxi after a day onshore, even though it could affect traffic congestion problems near to the CT, and to a lesser extent in the HC. The assessment of the quality of the PT is partial, as the subjective indicators (q) remain outside the equation and the effects of transfers in the use of PT have not been considered. Neither has the impact of COVID-19 been considered. The preference for using PT has dropped due to the fear of infection [62].

Future research could analyse the percentage of cruise tourists using PT to the MVMs, and compare the results obtained by a general quality assessment of the PT system. The methodology used may go beyond the study of the MVMs, as it could apply to any PT connection with any tourist draw and allows different PT services to be compared—in relation to tourism—in a straightforward and fast way. This study provided a rough assessment of each connection or line, unlike other quality studies that give an average value to the quality of the whole PT system at the tourist destination [10,33,48,53]. This will allow for a greater consensus when applying the required transport policies. Increasing the number of museums and expanding the studied tourist draws studied beyond museums would also add value to the study.

**Author Contributions:** Conceptualization, C.R.-J. and S.G.-C.; data curation, M.J.M.-B.; formal analysis, M.J.M.-B. and A.E.G.-M.; funding acquisition, C.R.-J.; investigation, S.G.-C. and C.R.-J.; methodology, C.R.-J. and S.G.-C.; resources, M.J.M.-B. and A.E.G.-M.; supervision, M.J.M.-B. and A.E.G.-M.; validation, M.J.M.-B. and A.E.G.-M.; writing—original draft, C.R.-J. and S.G.-C.; writing—review and editing, M.J.M.-B. and A.E.G.-M. All authors have read and agreed to the published version of the manuscript.

**Funding:** This article showcases the results of the "Strategies to recover the public space and residential use over gentrification and touristification in Malaga" research (UMA 20.01), financed by Andalusian Govern for Development, Infrastructures and Spatial Organization. The open access fee is funded by Universidad de Malaga/CBUA.

**Institutional Review Board Statement:** Not applicable

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Data is contained within the article.

**Acknowledgments:** The authors would like to thank Francisco Conejo-Arrabal for his participation in the elaboration of the graphic material and the search for sources. The authors are grateful to anonymous reviewers, whose helpful remarks on the previous drafts provided important inputs for the final form of this paper.

**Conflicts of Interest:** The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

## Appendix A

**Table A1.** Sources of population and annual volume of cruise tourists.

| City | Population | Cruise Passengers (Year) |
|---|---|---|
| Venice | Instituto Nazionale di Stadistica https://www.istat.it/ | https://www.port.venice.it/en/cruises.html (2018) |
| Málaga | Instituto Nacional de Estadística https://www.ine.es/jaxiT3/Tabla.htm?t=2882 | https://www.puertomalaga.com/es/estadisticas/ (2018) |
| Quebec | Institut de la statistique du Québec https://statistique.quebec.ca/fr | https://www.portquebec.ca/en/about/annual-reviews/economic-affairs (2018) |
| Copenhaghen | Statistik Denmark https://www.dst.dk/en/ | https://news.cmport.com/news/record-number-of-christmas-cruises-in-2018-399793 (2018) |
| Hong Kong | Census and Statistics Department https://www.censtatd.gov.hk/en/web_table.html?id=1A | https://www.cruisemapper.com/ports/hong-kong-port-13 (2017) |
| Amsterdam | CBS https://www.cbs.nl/ | https://www.portofamsterdam.com/sites/default/files/2020-06/jaarverslag-2018.pdf (2018) |
| Stockholm | SCB https://www.scb.se/en_/ | https://www.portsofstockholm.com/about-us/business-areas/international-cruises/ (2018) |
| San Francisco | U.S. Census Bureau https://www.census.gov/ | https://www.cruisemapper.com/ports/san-francisco-port-2#:~:text=In%202017%2C%20the%20port%20handled,and%20estimated%20around%20300%2C000%20passengers. (2018) |
| Vancouver | Statistique Canada https://www.statcan.gc.ca/en/start | https://www.portvancouver.com/wp-content/uploads/2019/05/2018_FinancialReport.pdf (2018) |

Note: All accessed on 22 November 2020.

## Appendix B

**Table A2.** Sources of the number of visitors/year per museum.

| City | Museum | Source |
|---|---|---|
| **Venice** | Galleria dell'Academia | https://www.comune.venezia.it/sites/comune.venezia.it/files/immagini/Turismo/Adt19%20ing%20ver%204%201%202021%281%29.pdf |

| | | |
|---|---|---|
| | Palazzo Ducale | https://www.comune.venezia.it/sites/comune.venezia.it/files/immagini/Turismo/Adt19%20ing%20ver%204%201%202021%281%29.pdf |
| | Peggy Guggenheim | https://www.guggenheim-venice.it/en/press/press-releases/visitatori-2017/ |
| | Museo Correr | https://www.comune.venezia.it/sites/comune.venezia.it/files/immagini/Turismo/Adt19%20ing%20ver%204%201%202021%281%29.pdf |
| | Ca'Rezzonico | https://www.comune.venezia.it/sites/comune.venezia.it/files/immagini/Turismo/Adt19%20ing%20ver%204%201%202021%281%29.pdf |
| **Malaga** | Museo Thyssen | https://www.carmenthyssenmalaga.org/uploads/pdf/info_economica/visitantes_2017.pdf |
| | Museo Picasso | https://www.museopicassomalaga.org/prensa/el-museo-picasso-malaga-supero-los-600000-visitantes-en-2017 |
| | Centro de Arte Contemporáneo | https://www.vidaeconomica.com/2018/01/cac-cierra-2017-mas-500-000-visitantes/ |
| | Museo Pompidou | https://ciedes.es/images/stories/2018/PRENSA/museorusofirma-subidavisitantes11.pdf |
| | Museo Ruso | https://ciedes.es/images/stories/2018/PRENSA/museorusofirma-subidavisitantes11.pdf |
| **Quebec** | Musée de l'Amerique Francophone | https://www.mcq.org/documents/10706/28705/Rapport_annuel_16-17.pdf/96e2e23a-49c8-4d18-a0c7-8fade9db2233 |
| | Musée de la Place-Royale | https://www.mcq.org/documents/10706/28705/Rapport_annuel_16-17.pdf/96e2e23a-49c8-4d18-a0c7-8fade9db2233 |
| | Maison Historique Chevalier | https://www.mcq.org/documents/10706/28705/Rapport_annuel_16-17.pdf/96e2e23a-49c8-4d18-a0c7-8fade9db2233 |
| | Museum of Civilization | https://www.mcq.org/documents/10706/28705/Rapport_annuel_16-17.pdf/96e2e23a-49c8-4d18-a0c7-8fade9db2233 |
| | National Museum of Arts | https://numerique.banq.qc.ca/patrimoine/details/52327/2321890?docref=O7LX0zI-kJLQLm9i1Wx84w |
| **Copenhagen** | Ny Calsberg Glyptotek | https://www.dst.dk/da/Statistik/emner/kultur-og-fritid/museer-og-zoologiske-haver/museer |
| | National Museum of Denmark | https://natmus.dk/organisation/nationalmuseet-som-organisation/opgaver-maal-og-historie/nationalmuseets-besoegstal/ |
| | Christiansborg Slot | https://www.dst.dk/da/Statistik/emner/kultur-og-fritid/museer-og-zoologiske-haver/museer |
| | Kongernes Samling | https://www.dst.dk/da/Statistik/emner/kultur-og-fritid/museer-og-zoologiske-haver/museer |
| | Louisiana Museum for Moderne Kunst | https://www.dst.dk/da/Statistik/emner/kultur-og-fritid/museer-og-zoologiske-haver/museer |
| **Stockholm** | Skansen | https://kulturanalys.se/wp-content/uploads/2020/09/Beso%CC%88ksutveckling-pa%CC%8A-de-centrala-museer-2017_v2-1.pdf |
| | Vasamuseet | https://www.stockholmbusinessregion.com/globalassets/about-us/facts-and-figures/facts-about-tourism/annually/arsrapport-20180906.pdf |
| | ArkDes | https://kulturanalys.se/wp-content/uploads/2020/09/Beso%CC%88ksutveckling-pa%CC%8A-de-centrala-museer-2017_v2-1.pdf |

| | | |
|---|---|---|
| | Naturhistoriska | https://kulturanalys.se/wp-content/uploads/2020/09/Beso%CC%88ksutveckling-pa%CC%8A-de-centrala-museer-2017_v2-1.pdf |
| | Moderna museet | https://kulturanalys.se/wp-content/uploads/2020/09/Beso%CC%88ksutveckling-pa%CC%8A-de-centrala-museer-2017_v2-1.pdf |
| **Amsterdam** | Rijksmuseum | https://www.parool.nl/nieuws/zaans-museum-verdubbelt-aantal-bezoekers-in-twee-jaar~b503d3c5/ |
| | Van Gogh | https://assets.vangoghmuseum.nl/fdb5ede9-e8b2-402c-9281-811858b37d94?c=4f64213ab2e3fc5f8244345085439f3661e210e73ca3592511d78924ead59f5a&_ga=2.152232121.1209573141.1646846538-1763507532.1646846538 |
| | Anna Frank House | https://www.annefrank.org/en/downloads/filer_public/3f/66/3f669dd5-11a0-43d1-bdae-93f0aeba507a/annual_report_2017_afh.pdf |
| | Stedelijk | https://s3-eu-west-1.amazonaws.com/production-static-stedelijk/images/_museum/Jaarverslagen/2017/engels/SMA_Annual%20Report%202017.pdf |
| | Rembrandt | https://www.parool.nl/nieuws/zaans-museum-verdubbelt-aantal-bezoekers-in-twee-jaar~b503d3c5/ |
| **Vancouver** | Science World | https://www.scienceworld.ca/wp-content/uploads/attachments/AR2017-2018_Online_2.pdf |
| | Vancouver Art Gallery | https://vancouverartgallery.pressreader.com/vancouver-art-gallery-annual-report/20180630 |
| | Museum of Anthropology | https://fliphtml5.com/xkla/ibcv/basic |
| | HR MacMillan Space Center | https://www.spacecentre.ca/sites/default/files/2017-hrmsc-annual-report.pdf |
| | Vancouver Maritime Museum | https://vanmaritime.com/wp-content/uploads/2020/02/vmm_ar_2017.pdf |
| **San Francisco** | De Young | https://www.famsf.org/sites/default/files/famsf_annual_report_fy17-18.pdf |
| | California Academy of Sciences | https://www.bizjournals.com/sanfrancisco/subscriber-only/2017/08/25/sfmoma-california-academy-of-sciences.html |
| | San Francisco Museum of Modern Art | https://en.wikipedia.org/wiki/San_Francisco_Museum_of_Modern_Art |
| | Exploratorium | https://www.exploratorium.edu/sites/default/files/annual-report-2017.pdf |
| | Legion of Honor | https://www.famsf.org/sites/default/files/famsf_annual_report_fy17-18.pdf |
| **Lisbon** | Museu Nacional de Arte Antiga | http://www.patrimoniocultural.gov.pt/static/data/museus_e_monumentos/estatisticas1/ev2017.pdf |
| | Museu Nacional del Azulejo | http://www.patrimoniocultural.gov.pt/static/data/museus_e_monumentos/estatisticas1/ev2017.pdf |
| | Museu Nacional de los Coches | http://www.patrimoniocultural.gov.pt/static/data/museus_e_monumentos/estatisticas1/ev2017.pdf |
| | Museu Nacional de Arqueologia | http://www.patrimoniocultural.gov.pt/static/data/museus_e_monumentos/estatisticas1/ev2017.pdf |
| | Museo Colecçao Berardo | https://www.museus.gov.br/wp-content/uploads/2017/04/20170406-CPAI-Ranking2016Pub-Comp-.pdf |

| | | |
|---|---|---|
| **Hong Kong** | Space Museum | https://gia.info.gov.hk/general/202108/25/P2021082500272_375180_1_1629865367168.pdf |
| | Museum of History | https://gia.info.gov.hk/general/202108/25/P2021082500272_375180_1_1629865367168.pdf |
| | Science Museum | https://gia.info.gov.hk/general/202108/25/P2021082500272_375180_1_1629865367168.pdf |
| | Heritage Museum | https://gia.info.gov.hk/general/202108/25/P2021082500272_375180_1_1629865367168.pdf |
| | Railway Museum | https://gia.info.gov.hk/general/202108/25/P2021082500272_375180_1_1629865367168.pdf |

Note: Malaga, Quebec, Copenhagen, Lisbon, and Hong Kong accessed on 23 April 2020. Venice, Amsterdam, Stockholm, Vancouver, and San Francisco accessed on 17 June 2020 .

## Appendix C

**Table A3**. Official transportation webs of the cities.

| City | Transport | Web | Accessed |
|---|---|---|---|
| Malaga | Bus | https://www.emtmalaga.es/ | 24 November 2019 |
| Quebec | Bus | https://www.rtcquebec.ca/ | 24 November 2019 |
| Copenhagen | Train | https://www.dsb.dk/ | 24 November 2019 |
| | Tram/Subway | https://m.dk/ | 24 November 2019 |
| Lisbon | Tram/Subway | https://www.carris.pt/ | 24 November 2019 |
| Hong Kong | Tram/Subway | https://www.mtr.com.hk | 24 November 2019 |
| Stockholm | Tram/Subway | https://sl.se/ | 24 November 2019 |
| | Bus | https://sl.se/ | 24 November 2019 |
| Amsterdam | Tram/Subway | https://en.gvb.nl/ | 24 November 2019 |
| Venice | Ferry | https://actv.avmspa.it/it | 24 November 2019 |
| San Francisco | Bus | https://www.sfmta.com/ | 24 November 2019 |
| Vancouver | Bus | https://www.translink.ca/ | 24 November 2019 |

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