

## *Article*

# Accessibility-Based Approach: Shaping Travel Needs in Pandemic Situation for Planners' Perspectives

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**Abstract.** The outbreak of acute respiratory syndrome coronavirus 2 (SARS-Cov-2) causing coronavirus disease (COVID-19) has affected travel behaviors and lifestyles in a matter of days and weeks. In transport planning process, the concept of accessibility is usually interpreted as an acronym of mobility. For decades, researchers have been advocating to interlink the mobility-based approach with accessibility-based approach. Despite considerable research work has been done for the development of accessibility measures, yet its effective use in transport planning is not very pervasive. In this research study, stress is emphasized to reflect on why significant progress for adopting accessibility-based approach has been difficult to accomplish especially in planning practices. Some of the promising efforts made so far have been highlighted. This study provides insights on the power of accessibility-based approach in urban settings and discussed why planners should adopt this approach to reshape safe travel behaviors in uncertain pandemic situations like COVID-19.

**Keywords:** Accessibility-based approach, pandemic, COVID-19, travel needs, planners' perspectives, travel behaviors, transport planning process.

## 1. Introduction

The outbreak of 2019 novel coronavirus (COVID-19) has affected travel behavior around the globe in a matter of days and weeks. The disease caused by this virus is highly contagious and spreads through close contact with the affected people. World Health Organization (WHO) is encouraging people to maintain a safe social distance of 2m (around 6-ft) among each other. Obviously, this concept is conflicting with shared-transit modes (i.e., public buses, trains, trams, ride hailing services and demand responsive transport), which have been propagated as potential transit modes in recent times [1].

Since decades, accessibility has been considered as an ultimate goal of the transport planning process [2]–[5]. The planners have been continuously acknowledging the importance and far-reaching impacts of accessibility on the development of the land-use since 1950s [2]. The greater is the accessibility of an area for various community activities, the greater are the chances of urban growth [6]. A comprehensive definition of accessibility was given by W. G. Hansen [2] as follows: “*Accessibility is defined as the potential of opportunities for interaction. This definition differs from the usual one in that it is a measure of the intensity of the possibility of interaction rather than just a measure of the ease of interaction.*”. However, the general concept of sustainability was later defined by Pirie [7] in three dimensions of research in transport modeling, welfare studies, land-use and, transport system analysis. It is considered as an acronym of convenience and reachability,

to gauge the effectiveness of the transport system in relation to land-use patterns. In other words, accessibility can be defined as; a way to characterize the available modes of transport. Accessibility is the ease with which the destinations around a given place can be reached by different active modes. In simplest manner, it tells the available choices offered to the commuters by the built environment to reach specific destinations. For example, if someone has many attractive stores near his house, then his accessibility for shopping is surely higher than the one who has limited number of poor-quality stores in neighborhood and/or located far away from his residence place.

On the other hands, mobility focused on the realization of the interactions through actual travel by transport modes [8]. Mobility-based approach traditionally focuses on motorized transport system, which is aimed to facilitate smooth movement of vehicular traffic. The general goal in this approach is to reduce the travel time and traffic delays by improving travel speeds and increasing Mass Transit Ridership [9]. To meet the demand, interventions are introduced for the improvement of the road network, neglecting land-use component which can improve accessibility. Mobility approach is generally used for cars and public transit systems [10], [11]. This mobility approach exposes the passengers to road safety issues, thus increasing the chances of road fatalities [12]. The main difference between accessibility- and mobility-based approach is shown in Table 1.

Table 1. Difference between accessibility- and mobility-based approach.

Accessibility-based approach	Mobility-based approach
<ul style="list-style-type: none"> <li>▪ Consider non-motorized transport as mode choice such as walking or bicycling.</li> <li>▪ Improve reachability concept.</li> <li>▪ Not generally speed dependent.</li> <li>▪ Land-use interventions are introduced to improve accessibility.</li> <li>▪ Can be measured by travel distance or travel time.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Consider motorized traffic such as cars or public transport as mode choice.</li> <li>▪ Improve vehicular traffic / flow</li> <li>▪ Speed and congestion dependent.</li> <li>▪ Road network interventions are introduced to meet demand, neglecting land-use developments.</li> <li>▪ Measured through level-of-service.</li> </ul>

There is no doubt that accessibility is a most appropriate focus for effective transport planning processes [3]. However, it is mostly mixed with the concept of mobility by many researchers and transport planners, making it difficult to realize the planning process to practice [13]. The first and foremost challenge is to completely understand with clarity that what is the meaning of “accessibility”, which is not always clear to many of the planners. The term “accessibility” is usually meant with important transport-related access, for example, the concept of “universal accessibility” is referred with the Americans with Disabilities Act (ADA). It is essential to provide the access to the persons with disabilities and physically impaired to the transit services. However, in the broader perspectives, it can be said that it

does not always means to provide access to ADA-related desired activities [14].

In this research study, we have assessed why we have made little progress towards the adoption of accessibility-based approach in practice. Why cars are still most dominant transit modes in different clusters of whether working or non-working group? [15]. Some of the recent promising efforts have been discussed which promoted the shift from mobility-based approach to accessibility-based approaches. It highlights why we need to cross the cusps from mobility-based approach towards accessibility-based approaches. This research study also provides insights on the power of accessibility-based approach in urban settings and discussed why planners should adopt this approach to reshape safe travel behaviors in uncertain pandemic situations like COVID-19. The major advantage

of adopting accessibility-based approaches is that they offer the success of the planning process by facilitating the trade-offs between transport systems, land-use and social needs. This approach focuses on the performance of the system as a whole instead of just one specific segment of the transport network [16].

The remainder of this research is divided into the following sections. Section 2 discusses the pertinent literature studies. Section 3 describes the challenges for the adoption of accessibility-based approaches in transport planning processes. Section 4 highlights the recent advances made in efforts to promote accessibility-based approaches over mobility-based approaches for sustainable and safe compact societies. Section 5 stresses on the need that why accessibility-based approach is a way forward for planning safe and sustainable societies in uncertain situations (i.e., SARS-Cov-2 and COVID-19). Finally, some of the conclusions are made and policy suggestions are proposed to change the planning perspectives of the practitioners.

## 2. Literature Review

Since 1950s, the concept of accessibility has been encouraged by the researchers and practitioners. For example, W. G. Hansen [2] illustrated the empirical model about how accessibility shapes the land-use systems. She presented the basic operational definition of accessibility and suggested methods for determining accessibility in the metropolitan regions. Wachs et al. [3] presented a discussion about why accessibility should be incorporated as an important component in the “social report” of a city or metropolitan discussing the quality of urban living in terms of accessibility to employment and urban services. An axiomatic mathematical approach to measure accessibility was presented by W. Weibull [17] which contained the sub-class of gravity potentials to assess the accessibility measure of the Stockholm region from employment opportunities perspectives. Pirie et al. [4] attempted to clarify the confusion of accessibility by examining the strengths, limitations, and conceptual bases of gravity, topology, distance, and cumulative measures of accessibility. It was proposed that accessibility can be thought as a vacancy in activity routine and can be measured in terms of disruptions involved in creating it. P. L. Knox [18] argued that accessibility is an important component which defines the quality of life by its measure of reachability to jobs, amenities, and services. He stressed on the need to include the importance of physical accessibility as a social indicator. A measurement theoretic framework was presented by W. Weibull [19] for mathematical measurement to consider accessibility as a property of configurations of an opportunity for spatial interactions. S. Handy [20] introduced the concept of “regional accessibility” and “local accessibility” by testing the implications of shopping travel behaviors in San Francisco Bay Area.

Accessibility is measured by spatial distribution of the intended destinations, the ease of reachability,

characteristics of the activities found there, the magnitude and quality of the urban amenities and services. Individuals’ needs to travel arises from their need to participate in certain activities and they plan their activity sequence based on their needs [21]. S. L. Handy [13] identified the issues hindering accessibility goals and reflected that accessibility has been rarely translated into practice despite substantial evidences in the literature studies. Shen et al. [22] described the concept of accessibility by comparing the speed versus density conception and reported that most of the times, accessibility is translated with higher speeds, which is relatively unimportant. Yet, the central idea of accessibility should revolve around the number of interactions that can be done within given time and distance. Mondschein and Taylor [23] proposed congestion-adaptive travel choices (i.e., walking and bicycle) for shorter travel distances in congested neighborhoods and recommended that planners must create such places to increase accessibility. Primerano and Taylor [24] argued that accessibility goals are always included in the planning process but hardly translated into practice and most of the times, its concept is connected with transit-oriented approach (mobility-based approach). Boisjoly et al. [25] identified the gap between planning and practice of accessibility metrics by interview surveys of 343 practitioners around the world and found out that a huge number of 55% of them stated that they are not using the accessibility-based approach in practice and pointed out that lack of knowledge and data are the main barriers in practice. Different discussions between developers of various accessibility instruments and practitioners in European Union revealed that practitioners agreed on the fact that proper insights were provided by accessibility instruments, but manifested that organizational barriers and lack of institutionalized accessibility are the main causes of gap between planning and implementation. Accessibility index created by Proffitt [26] after performing content analysis of 42 US regional transport plans referred that lack of clarity on accessibility consider vehicle speed as a success criteria in most of the plans. The high income areas have better planning capacity to produce accessibility-based approach plans because of more resources and recommended that there is urgent need to amend guidelines of the federal plans for speedy adoption of accessibility-based approach instead of mobility-based approach. Susan L. [27] argued that wider cycling lanes and car speed management create comfortable cycling environment for easy accessibility on roads where protected or separate lanes are not feasible.

This research is aimed to provide the concept of accessibility by incorporating the idea of “city for shorter distances” in planning perspectives for practitioners. This concept can be used as an acronym of “compact cities” where commuters can access the necessities within shorter distances by using walking or cycling as a transit mode, in pandemic situations (like COVID-19) when motorized transport is not a viable option. In this concept, accessibility is defined in terms of proximity instead of mobility. Freiburg, Germany is a pioneer in propagating

the idea of how the dependence of cars should be reduced in cities. However, integrated traffic management plans set the idea of more accessible cities on a different path by including public transit modes [26], [28-29]. Which are no longer safe travel modes in pandemic situation because of the dangers of widespread of infectious diseases like COVID-19 if safe distance is not maintained [30].

In uncertain pandemic (COVID-19) situations, like this walking and bicycle are seemed to be the most sustainable and feasible transit modes, so there is an urgent need to propagate this idea for planners to adopt accessibility-based approach in planning and practice instead of mobility-based approach or transit-based approach.

As it is evident from the literature mentioned above that transport and urban planners have written a flurry of researches in 1970s and 1980s [3-7],[15-16]. But still, why the core concept of accessibility is not employed as a guiding philosophy in transport planning processes? Even with so much academic writings have been lettered on its conception and development, why did we find very little evidence on its use in practice? Even after decades, why the accessibility measure is not very pervasive in transport planning processes? Why practitioners and planners does not adopt accessibility-based approach? While, this is the need of the time, especially in pandemic situations (like COVID-19) when active transport modes (i.e., walking and cycling) are considered only viable transit modes [30].

### 3. Challenges in Adoption of Accessibility-based Approach

The concept of accessibility has been propagated since 1970s and 80s. Its concept has been promoted by many researchers as an important component to measure the performance of the metropolitan system. However, there was a lack on the consensus and agreement in the definitions and measurement of accessibility [31]. Some of the key findings which offered insightful guides in a simple yet powerful way are reported by [3-7],[15-16]. They referred the accessibility to services and employment as a social indicator for metropolitan regions or cities relating it to “the quality of urban living.” W. Weibull [17] devised a mathematical approach for the measurement of accessibility and defined it a powerful idea as “an aspect of the freedom of the actions of the individuals.” These research studies provided an optimistic approach towards the accessibility-based approach for transport and urban planning.

Even after more than three decades, H. Susan [32] pointed out that despite of the optimistic approach, the change from planning to practice did not occur significantly. She analyzed four transport plans in California, United States and referred that Metropolitan Planning Organizations (MPOs) often mention “accessibility” in their urban plans but the core definition of accessibility still lacks and offer very little insights in the actual meanings of the terminology. Mostly this term is defined in conjunction with the mobility-term, with no

significant differences. For example, the performance report of Metropolitan Transportation Commission (MTC), for its regional plan stated this baffling statement, “*Accessibility is a significant measure of mobility because transportation is rarely an end in itself.*” She assessed MPOs to analyze how much they have attempted to accomplish the articulated goals of accessibility, and if accessibility is used as a measure of progress towards goals or so. She found that only one MPO entwined accessibility measure to accessibility goals, rest of the three MPOs linked mobility measure to accessibility goals.

A recent study by Proffitt et al. [26] analyzed the use of accessibility measure in 42 of the regional MPOs in the US and inferred that most of the MPOs didn’t included accessibility-based approach. The findings of the study referred that though most of the MPOs included accessibility as a goal, but only a few of the MPOs defined accessibility or accessibility measure. The study found out that areas with higher income included accessibility measure in their MPOs because of the greater planning capacity and resources. Boisjoly et al. [25] investigated the responses of 343 practitioners around the globe and demonstrated that lack of knowledge and data were the main hindrance barriers for accessibility measure in practice. A significant number of respondents (99%) reported that they are familiar with the concept of accessibility. But only 55% manifested that they used them. The widespread use of accessibility might depend upon the availability of widespread technical assistance, which need huge resources.

There are some signs of hope as performance-based planning requirements for federal policies around the globe, have started adopting accessibility-based approach to meet end goals of accessibility. A recent report by Brookings Institute [33] aimed at pioneering research for building stronger bridges between researchers and practitioners in pandemic situations. It might help in providing guidance to MPOs and MTCs for measuring accessibility in different perspectives and move the concept of accessibility “from theory to practice.” The current pandemic has urged the need that planners should amend their planning processes from mobility-based- to accessibility-based-approaches for realizing safe travel needs of the commuters in urban settings.

### 4. Promising Efforts of Accessibility Adoption

The recent efforts to ensure the improvement in accessibility-based approach are quite encouraging for planning practice perspectives. It is important to devise the standardized measures for ensuring accessibility. However, there is not a single right way, but arguably many of the options to measure accessibility depending upon the objectives and motives, affecting the purpose of analysis [13]. However, despite of the plethora of possibilities, it would be much important to devise standardized mechanisms for measuring accessibility to help planning agencies.

A conference hosted by University of Minnesota in 2004 reflected some of the renewed interests in

accessibility. This conference attracted researchers from across the globe to share their thoughts and work pertinent to accessibility, methods to assess accessibility and possible explorations of its role in planning and policy. The proceeding of the conference documented some of the important efforts to improve accessibility but highlighted that a serious effort to link planning with practice is much necessary for the translation and realization of the ideas into execution [34]. This conference was apparently a major uptick in academia around accessibility, yet it was concluded that serious action remains inefficient on its practical applications.

The advances in academia did not necessarily translated into practice. The COST Action TU1002 project was launched in Europe in 2010 to bridge the gap between planning and practice perspectives of accessibility. This project attracted 150 academia professionals and local practitioners from 22 countries [35]. In the first part, this project focused on the development and delivering the instruments of accessibility for use to the practitioners. In the second part, an assessment of the usefulness of these instruments by practitioners as well as case studies of their use in practice were discussed. The main findings of the project report highlighted that it is quite hard for the practitioners to grasp the concepts of accessibility, which are varied considerably. The accessibility instruments are seemed complex, inflexible, and incomprehensible black boxes for most of the practitioners. The project report recommended that researchers, “...keep on developing ways to explain accessibility indicators and mechanisms in lay terms, so that all the actors in the planning processes are able to understand and work with the tools” [36].

Still, the indications of the progress made so far give a reason to be hopeful, beginning with the simple fact that many of the MPOs in the US started using accessibility as a goals, as referred by Proffitt [26]. The development and availability of different commercially available packages which provide data and algorithms to measure accessibility have made the jobs far easier for MPOs. The efforts of the researchers from academia to bridge the gap between planning and practice also seems helpful. In the US, The National Cooperative Highway Research Program (NCHRP), initiated a program funded by the Department of Transportation to provide guidance and assistance in formulating policies to help agencies for measuring accessibility for the perspectives of different purposes.

The latest pandemic situation (i.e., COVID-19) might serve as a push for the failure of mobility-based approach to incline planners to adopt accessibility-based approach, growing concerns of health and other financial constraints have made it clear that mobility-based approach is infeasible. Additionally, the contribution of negative externalities of driving-based transport systems (mobility-based approach) is one of the main concerns to the climate change crisis. This pandemic has changed the paradigm of travel behaviors. The necessity to recognize the cracks of failing mobility-based approach due to health safety and climate change concerns have realized the urgent need to

reduce vehicle-miles-travelled. Converging these forces of concerns have compelled the recognition of accessibility-based approach, that practitioners must adhere to the idea of accessibility for safe compact societies.

## 5. Why Accessibility-based Approach is a Way Forward?

In view of the recent pandemic (COVID-19) outbreak, serious efforts should be put forth to improve the measure of accessibility for practice perspectives. Without any doubt, it is an encouraging notion in shifting transport planning processes away from mobility-based approach to accessibility-based approach. The use of the concept of accessibility, as a way to think about more livable urban environments can itself be quite useful for urban and transport planners. We believe that grasping the core concepts of accessibility are not harder than the concepts of understanding vehicle delays [23]. Some of the European cities, however, have been doing quite well for the adoption of accessibility measure because of their long-term planning practice [36].

The emerging idea of accessibility from Europe is the “city of short distances”. It is originally German concept, “der Stadt de kurzen Wege”, a synonym of the idea of the compact cities. According to this concept, all necessitated places should be within proximity of short distances which can be reached by walking or biking, a real possible means from home. This concept relays on the concept of proximity instead of mobility. Freiburg, Germany can be taken as an example of the model city which discourages the dependence on cars, reducing vehicle-miles-travelled. Recently, the mayor of Paris floated the idea and started campaigning “15-minutes city” concept where residents can get access to all their needs within 15-minutes from their home by active transit modes such as walking or bicycling [31].

Many of the European cities have been doing quite well in combining the accessibility within the neighborhood, where you can reach regional centers by walk or bicycle. Restriction on personalized vehicles in the city centers, have made the transit easier option than driving [37]. Though, many of the Europeans might opt to drive but they always do not have the option to opt to. They are having quite a good accessibility to meet most of their daily needs within proximity without having need to drive [31].

It is quite important to understand the difference between “regional accessibility” and “local accessibility”, it will help in determining how planning goes wrong, which for decades focused on moving people by motorized transport, a mobility-based approach. By following this approach, it provided good regional accessibility initially, neglecting local accessibility. But, as the congestion level risen, regional accessibility declined, providing no fall back for residents that could compensate for reduced regional accessibility. Therefore, regional accessibility has been limited by motorized transit options, which are perceived not safer options anymore in

uncertain times of pandemic like this COVID-19 outbreak. In nutshell, the mobility-based approach has not provided accessibility options that are resilient to travel in pandemic situations like this. Rather, it provided vicious cycle which is bound to fail in the end.

Many of the researchers [28], [34], [38] have pointed out how US cities are promoting close proximities and higher densities for enhancing local accessibility, which is a good way to reduce the need to drive or ride motorized transport. Levine et al. [38] have well-explained the difference between regional accessibility (speed-dependent) and local accessibility (proximity-dependent), suggesting that good proximity overcome speed dependence. Mondschein and Taylor [23] pointed out in their findings that if places offer better options of walking and bicycling, the net impact of agglomerations for accessibility is always positive. A good local accessibility with least dependence on mobility-based approach (regional accessibility) can be more resilient in uncertain pandemic situations.

The Dutch concept of “woonerfs” and the British translation “home zone” reflect the idea that users must meet all their needs, by enhancing local accessibility, reducing prioritizing cars and motorized vehicles. This concept reflects in prioritizing local accessibility as an option which puts active modes such as walking or bicycle, improving the quality of public spaces over speed dependence movements. By doing so, planners can pay full attention to the quality of life that influence accessibility, beyond what is usually incorporated into accessibility measures [28]. By this, they are knowingly or unknowingly addressing the idea of B. Newbould [5], who felt qualities of access which citizens priorities – relating to comfort, safety, enjoyment, and reachability. However, quantifying and combining all these qualities would be a challenging task, and ultimately not necessary. But it is important to think about the environment in order to assess that which qualities influence the perceived accessibility and what changes are required to improve accessibility. K. Lynch [6] was one of the pioneers who floated the idea of street design from the perspectives of contribution to accessibility.

The basic idea of accessibility-based approach is to devise policies to preserve the downtown as a commercial hub and limiting the outward sprawl. Land-use policies provide smaller commercial hubs, healthcare, shopping, workplaces, open spaces, education, and religious centers while promoting infill developments, and limiting destinations within relatively smaller and shorter distances which are easily accessible by walking or bicycle. The city should provide not just good regional accessibility but good local accessibility. Planners must pay much attention to the fact that alternatives of speed-dependent mobility are not just viable but appealing specially in pandemic situations. This will result in highest share of daily commuters by walking or bicycle providing safe, comfortable, and accessible reach to their destinations. These planning perspectives will not only provide congestion-free zones in cities but the idea of “15 min city”

or “cities of shorter distances” will emerge as a new trend in planning practice, providing possibly safe commute in pandemic situations like this COVID-19. A distance from home to above-mentioned places would be a good indicator to assess accessibility measure, if it is reachable by walk or bicycle within 15-minutes. This simple approach, if employed through holistic framework, might produce fruitful insights for planners for the translation of accessibility from planning into practice.

## 6. Conclusion

The recent outbreak of COVID-19 pandemic has stressed to revise post COVID-19 transport policies, which are usually based on mobility-based approach. Most of the time, the concept of accessibility is represented as an acronym of mobility referring as how easy it is for commuters to move? For decades, the researchers have been agreeing on the fact that accessibility should be the ultimate goal of the transport planning process. However, the very core concept of accessibility is missing in the body of the literature and often linked or misunderstood with the mobility-based approach. Accessibility-based approach can yield real positive impacts on reducing the environmental concerns and improving quality of life by facilitating safer commute in uncertain pandemic situations (i.e., this COVID-19 outbreak). This research study highlighted the main impediments which caused the slow progress in shifting from mobility-based approach to accessibility-based approach, which undoubtedly have many explanations. Naming few, the misunderstanding of the core concept of accessibility, lack of consensus on accessibility measures, standardization of level-of-service measures in accessibility, complexities of accessibility measurement tools, organizational barriers and lack of institutionalized accessibility are main barriers to bridge the gap between planning and practice of accessibility measure. Though, some of the recent efforts have been put forth to enhance accessibility. In Europe, COST Action TU1002 project, which was designed to bring developers, academia and practitioners yielded positive results, suggesting that conducting workshops can positively contribute in improving the use of accessibility-based approach in practice [36]. But still congestion remains a dominant concern for public and politicians who prefer solutions which improve mobility instead of accessibility, usually resulting in adding or improving highway capacity by network interventions. However, these uncertain times of pandemic (COVID-19 outbreak) coupled with growing severity of congestion and climate concerns might force the planners to adopt accessibility-based approach for safe and easy access to destinations instead of mobility-based approach, which is still dominant in transport planning process. There is a great need of the time to usher accessibility-based approach in transport planning practice so that modern urban compact societies will be well-prepared for any future pandemic outbreaks similar like COVID-19.

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