

Transportation Planning Studies for Socio-Economic Development of Depressed Sub-Regions: A Review

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ABSTRACT

Transport sector can be considered as a backbone of the national and regional economies. Well-arranged transportation facilities are essential for the movement of people and goods, which can make nations agile and strong to face ever-increasing global and local socioeconomic problems. However, most of the developing countries were facing acute transport-related problems, i.e. absence of transport policies, inaccessibility, the proper road network hierarchy and unavailability of low-cost transportation services, especially for rural dwellers. Hence, the aim of this research is to propose policy implications by reviewing suitable literature associated with regional transportation planning, which can be essential to upsurge accessibility standards and abolish the transport-related problems of the rural sub-regions of developing countries. This research article is intended for the planned development and socioeconomic well-being of depressed sub-regions, which are struggling with the problem of transportation inaccessibility over the years. It was found that accessibility is a dominant element of transportation studies in rural sub-regions, if addressed by the concerned authorities or planning agencies; the deprived sub-regions can flourish and prosper with the passage of time.

Key Words: Transport Sector, Socioeconomic Development, Depressed Sub-Regions, Transport Inaccessibility.

1. INTRODUCTION

Planning is a multi-disciplinary approach [1,2], which is connected with our lives over the years and played a pivotal role in the civilization of mankind [3]. Regional Planning is a tool that can assist in initiating the development process within remote or depressed sub-regions. The depressed sub-regions can be defined as, “the regions having low employment opportunities and labor productivity, migrating

population in search of a better life, poor physical and socio-economic infrastructure, declining socio-economic opportunities, low per capita and household incomes, struggling agriculture sector and inaccessible deprived urban or rural population [4]”. Inaccessibility can be considered as a main cause, which shattered the ability of the rural population to reach desired destinations on time. Hence, in this situation, transportation sector can inject

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planned growth within destitute sub-regions and support socio-economic sectors, by improving accessibility standards and reducing travel time, both for freight and passenger transportation purposes.

Regional Transportation Planning is one of the disciplines, which tremendously took men to the modern era and assist in travelling thousands of miles efficiently and comfortably. Transportation planning is a crucial component for the economic development of aloof sub-regions [5]. In remote environments, it is the only hope, which gives access to economic opportunities and makes rural economies stable [6]. The explanation of the regional transportation planning scenario can be viewed in Fig. 1.

It is palpable from Fig. 1 that the village population uses minor unpaved tracks to access nearby surroundings for the purpose of firewood, drinking water needs and agriculture. The same village when connect to the neighboring town uses minor paved roads for the purpose

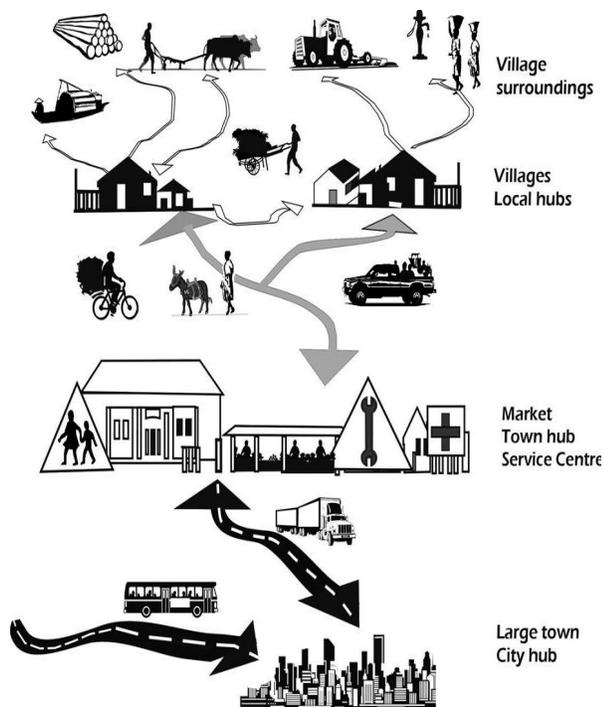


FIG. 1. RURAL-REGIONAL TRANSPORTATION SYSTEM [7]

of health, education, service center and market accessibility. The town is connected with the city by arterial road or primary road, and having heavy traffic, like trucks and buses, etc.

The transportation sector can truly assist rural sub-regions from many aspects, like accessing basic services, completing daily activities, and travelling efficiently. It is proven that efficient completion of household activities put positive impacts on sub-regional socioeconomic structure and economy. Easy and efficient completion of daily routine activities of rural households is possible with the provision of apt land use standards and transportation services. For example, Fox [8] conceptualized human activities, which are efficiently served by regional transportation planning. These different activities can be shown in Fig. 2.

Fig. 2 demonstrates transportation activities of rural households. The improved regional transportation system provides a husband liberty to enjoy easy access to his workplace. After finishing his work, he can walk for sports activities, which are easily accessible to him. His son drives his car to school that picks his father for a home from the sports complex after fishing school. Now, wife can use the same car for shopping and can meet with friends without any hindrances. The grandmother can do some hangouts nearby open spaces with her pet. In this way, the overall household activities furnished efficiently without any problems and delays. Therefore, it seems positive to have regional transportation guidelines, which could assist in accomplishing household activities and valuate the scope of the regional transportation system. In order to provide transportation solutions and way-outs, this review study was conducted to propose policy guidelines and highlight the importance of transportation studies in the development of rural sub-regions of developing countries.

The development of rural sub-regions can not only be accomplished by inducing the transport sector alone; one other important sector is vital in this regards, i.e. agriculture. It is really significant to promote the agriculture sector, by promoting rural-urban transport linkages and enhancing transport flows, as peasants can reach urban markets timely to earn valuable profits of their agricultural products. Thus, to strengthen the rural economy, it is expedient to promote the agriculture sector, which is the backbone of the rural-regional economy. Agriculture is a dominant sector, on which most of the rural economy depends, but due to unavailability of transport services, this sector is also tumbling in most of the rural sub-regions of developing countries.

2. REMOTE REGIONS AND AGRICULTURE

At segregated areas, ranchers without market data, and attempted to address with the issues of the purchasers from sustenance security and quality points of view. Accordingly, they are not having the capacity to give institutionalized farming items on a persistent premise [9]. It is to a great extent perceived that separated sub-

locales regularly experienced higher expenses of the items than the market. The cost of transportation administrations assumes a grave part in clearing up the relationship amongst openness and horticultural advancement. Costs reflected and identified with the help of purchase inputs or item showcases, the greater part of the circumstances approximated, similar to its nearness to the road density [9-11].

In an article “Agricultural Marketing and Access to Transport Services,” Hine and Ellis [12] illuminated that many developing nations anguished from monopolistic, low-volume high cost transportation and advertising frameworks. On the off chance that vehicle administrations are uneven of hopeless class or exorbitant, at that point workers would be in basic conditions and defenseless against monetary misfortunes, when they would endeavor to exchange their agrarian items. Similarly, costly transportation administrations will actually prompt low-cultivate entryway costs (the net value, the agriculturist gets from offering his product). Occasionally closed roads and irregular transportation offices, combined with lacking of storerooms for horticultural items can prompt misfortunes, as a few harvests (e.g. Wheat,

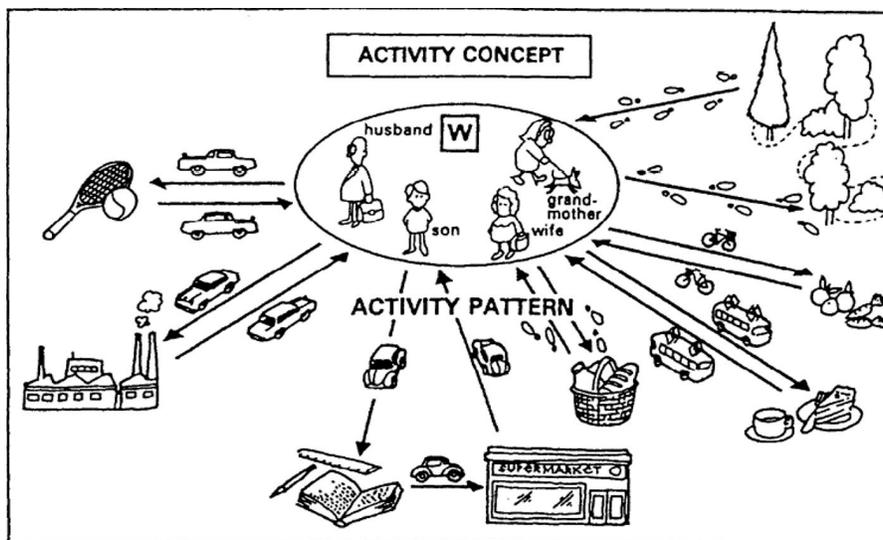


FIG. 2. TRANSPORT PLANNING AND HUMAN ACTIVITIES [8]

Cotton, Rice and Sugarcane) deteriorate quickly with the progression of time. On the off chance that an excursion to the market is made over uneven streets, at that point organic products (e.g. Bananas, Mangoes and Oranges, and so forth) may likewise experience the ill effects of wounding, which would be brought about budgetary damages to the producers. IMT (Intermediate Means of Transport) can be advantageous option in such circumstances, since it is invaluable in dropping-down the transportation cost and time. The consequences for the agrarian generation can be complex:

- (i) Cultivation on vast territories
- (ii) Production of money products
- (iii) Increased utilization of composts
- (iv) Reduction of transport time, halfway utilized for the money era
- (v) Spillover impacts, if creatures are utilized for transport.

Along these lines, keeping in mind the end goal to handle such predicament arranging strategies are required, which can counter such rustic local issues. Provincial transportation approach arrangements are profitable in dealing with the present issues of availability at rustic areas and give facilitate proposals to consistent development. Local advancement specialists are in charge of making strategy arrangements for arranged improvement. The concerned specialists of rustic locales of the creating scene dependably attempted to address with the issues of normal men because of numerous hindrances. Therefore, the concerned experts neglected to dispatch arrangement recommendations so as to determine the vehicle related issues. Because of this, fundamental bottlenecks not cured in time and more regrettable with the progression of time.

3. LITERATURE REVIEW

Regional transportation planning is provided for the smooth transportation system of the entire region, which not only handled urban, but rural areas as well. However, due to some political influences and other inevitable reasons, the emphasis was always put on the urban area's planning in developing countries. Whereas, rural regions get problematic day by day due to negligence with respect to the availability of development funds and policy plans [13]. As a result, rural regions get "depressed" with improper road network hierarchy [14], unavailability of the public transportation system including rural roads [15], no employment opportunities [16], lack of basic health and education services [17-19], no land-use zoning regulations [20], the shortage of recreational spaces [21], unavailability of markets [22], no commercial centers and migrating people towards the developed regions in search of a better life [23,24].

Prior to the decade of '80s, preliminary approaches were mainly targeted transportation networks (e.g. provision of road facilities for motorized transport), and it was assumed that motorized transport is capable of solving the transport-related issues of rural households living in backward regions. After the decade of '80s, transportation emerged as a supporting tool to enhance accessibility by encouraging rural-urban linkages and flows, which are essential especially for the socio-economic welfare of deprived regions and rural communities [25]. This changed scenario has developed many concerns about the rural regional transportation system in developing countries, which failed in producing the expected development outcomes in rural regions. It was observed that the most important part of the rural-regional voyage, i.e. off road network could not be undertaken using road and car approach [26].

The availability of transportation facilities and infrastructure are pretty much essential to renovate backward rural communities [27,28]. It is also understandable that alone availability of proper transport facilities could not bring prosperity within deprived rural environments. Hereafter, many other related sectors have to play their role in the sustainable socioeconomic development of remote sub-regions [29]. The rural-regional transport involves movement of people and goods to their relevant destinations. An efficient transportation system of any area has the mixture of small and large vehicles, which are being used for the public and personal uses.

IMT can be regarded as a useful travel and transport option for rural areas [30]. IMT is an essential transportation mode, which can be provided for the basic accessibility to the rural inhabitants. IMT comprised of bicycles, rickshaws, wheelbarrows, animal-driven vehicles (carts and wagons), motorcycles, motorized three-wheelers and two-wheel tractors [31]. This mode can augment inter and intra sub-regional traffic flows between urban and rural areas, together with the increase in transportation demand. As demand for transport increases larger traffic flow expected between urban and rural areas and within the regions [32]. Mostly, higher traffic demand can be viewed at terminals, markets, and different stations, etc. A viewpoint of transportation planning has been transformed over the years. This changing scenario gradually based on the needs of the retrograde societies and households in deprived rural regions [33]. As shown in Table 1, researchers developed various transport-related tools or models, which can be used for the development of regressive communities. From the models as mentioned in Table 1; Gravity Model, Trip Generation Model, Travel Demand Model, Alonso Model and Trade Model are extensively utilized for the development of regressive communities.

The models as mentioned in Table 1, can be useful to implement various transport-related projects or studies to mitigate the problems of rural inhabitants. In addition to these models, need-based approach, on the other hand can provide credible solutions to the problems of deprived regions. The need-based approach can be implemented in a systematic process by taking assistance from the transportation planning process. The transportation planning process provided the orderly procedure to resolve the different issues related to the execution of rural transport projects.

4. REGIONAL TRANSPORTATION PLANNING PROCESS

The transportation planning process is an ordered procedure of managing different regional transportation planning activities, like health, education, shopping, work, employment and recreation. The stages as used in the transportation planning process can be utilized for the efficient completion of transportation projects [41]. The different steps and stages of the regional transportation planning process can be shown in Fig. 3. The numbers are added against each stage, which further clarify the flow of stages involved in the process.

The hierarchal steps as shown in Fig. 3 represent an ideal situation to tackle ever-increasing problems of rural regions. It is not always feasible to go through all these steps because of the constraints and local conditions, but whenever possible, it is worth considering all these steps of the regional transportation planning process in transportation planning research studies and development of rearward sub-regions. The stages as mentioned in Fig. 3, can also assist related transport authorities and transport planners to comply with the emerging transport-related issues of rural sub-regions.

5. REGIONAL TRANSPORTATION AUTHORITIES AND TRANSPORT PLANNERS

Regional transportation authorities are developed to look after the regional land-use zoning, transportation

related problems, environmental conditions and overall planning and development matters with their jurisdiction. These authorities are responsible for making the plans and devise them accordingly for urban as well as rural regional areas. Concerned authorities prepare the plans, targeting traffic congestion problems mostly in urban

TABLE 1. REGIONAL TRANSPORT MODELS

Model	Mathematical Look	Persistence
Compound Interest Model[34-35]	(1) $P_t = P_o (1+r)^n$ (2) $r = (P_t/P_o)^{1/n} - 1$	To project demographic features of regions.
Gravity Model(Population Based) [36]	$(B_a/B_b) = [(P_a)/(P_b)] [(D_b/D_a)]^2$ OR $I_{ij} = K * P_i * P_j / D_{ij}^2$	Traffic flow towards a particular point can be estimated with the help of this model. Many parameters, like market-distance from residential areas and their population can also be utilized.
Competing Destination Model [37]	$P(C_j) = (S_j/T_j k) / \sum_j (S_j/T_j k)$	This model computes the shopping possibilities about consumers, to shop either at locations (i) or (j).
Trip Generation Model [37]	$O_i = f(x_{i1}, x_{i2}, x_{i3}, x_{i3})$ Where, O_i = Trip Generated by Zone I $x_{i1}, x_{i2}, x_{i3}, x_{i3}$ = Socioeconomic Characteristics of Zone i	This model calculates the number of trips between origins and destinations.
Travel Demand[37]	$dx_y = k O_x D_y f(cxy)$ cxy : travel cost from zone x to y * dx_y upsurges as cxy declines.	Traffic demand for specific zones can be determined with the help of this model.
Traffic Assignment Models [37]	Travel demand can be computed with the help of this model.	Gives information about the origin, destination and complete transport network features.
Alonso Model(Based on three equations) [38]	$T_{ij} = A_i^{1-\alpha} V_j B_i - \beta W_j F_{ij}$ $A_i = [\sum_{j=1}^n N_j B_j^{1-\beta} - \beta W_j F_{ij}]^{-1}$ $B_j = [\sum_{i=1}^m A_i^{1-\alpha} W_i F_{ij}]^{-1}$ Observed flows between i (origin) and j (Destination)	Traffic flows can be computed and predicted with the help of these models, including regional movement and trade.
Break-Point Model [39]	$D_{a \rightarrow b} = d / 1 + \sqrt{P_b / P_a}$	Break point is explained in this model between two urban settlements. Customers living nearer to break point have 50% livelihood of shopping in either settlement.
Trade Model (Huff's) [40]	$P_{ij} = (S_j \div T_j^b) / (\sum_{j=1}^n S_j \div T_j^b)$	Trade possibilities regarding locations can be computed with the help of this model, where customers may be attracted.

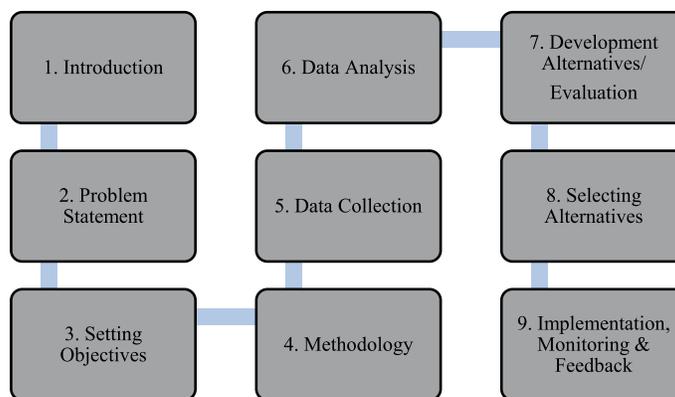


FIG. 3. REGIONAL TRANSPORTATION PLANNING PROCESS

areas and solve the problems of transportation unavailability in rural regions. The handy tools, which are used mostly by the authorities to solve the transport sector and related problems are plans and policies, which are actually prepared with the help of experts, like Planners, Engineers and Architects.

Most of the concerned regional transportation authorities are carrying out the responsibilities of planning and development works. These authorities formulate policy plans for planning, designing, managing, reviewing and balancing the needs of the community by keeping in view the physical, socioeconomic and environment criteria. The transport policies in rural regions focus the individual accessibility issues with respect to basic facilities and amenities, like health, education, employment, work, recreation and markets.

Mostly transport planners are assigned jobs of making or formulating regional transportation policy plans with the help of other professionals, like Civil Engineers, Architects or Surveyors.

With reference to society of transport planners [42], the duties/jobs of regional transport planners are listed as follows:

- (i) Give economic, social, and environmental consideration of their job
- (ii) Understanding about planning standards and provide a framework for the future
- (iii) Formulate regional transport policies that can assist in planning, and development of physical, socioeconomic and environmental sectors of the concerned rural region
- (iv) Planning and designing of regional transport projects and services

(v) Knowledge about the implementation tools of the concerned projects

(vi) Pleader of the community and expert in communication skills, planning and management.

Regional transportation plans are prepared to remedy the existing transport-related problems, and to provide the framework for smooth future development. The concerned transportation authorities prepared regional transport plans, which focus the problems of the rural population with respect to accessibility, and the availability of transport services in developing countries [43].

6. TRANSPORTATION POLICY PLANS AND RURAL ACCESSIBILITY

The development of transport-related policies and models [44] required data about household characteristics, travel patterns, land uses and socioeconomic features of the rural-regional population [45]. The decisions can be devised and executed with the help of transportation policy plans. Such plans, when implemented can eradicate the problems of rural households with respect to the availabilities of transportation services and facilities.

Accessibility and mobility factors of transportation planning can greatly influence socio economic well-being of the rural population [46]. In the past, transport-related services were analyzed with reference to the mobility criterion (physical movement). Later on, accessibility parameter was considered, i.e. “the ability of people who are interested in accessing goods, services, opportunities and employment, etc.”

Accessibility can be measured with the help of two well-known components, i.e. transportation and activity [47,48].

- (1) The activity component is a measure of land use classification in any region, which is shown by different destinations (opportunities). These destinations can be employment, education, health institutions or commercial areas. These destinations or opportunities can be given weights in order to calculate the attractiveness of flow of traffic. Shortages of these facilities according to the number of inhabitants can create accessibility problems, especially at deprived scattered locations.
- (2) The transportation component can be used to measure transportation system, like travel time, travel cost, household size, household income and personal vehicle ownership. These are also called impedance factors, which negatively impact the different journeys and often concluded in their cancellation.

The other components of accessibility measure are temporal (time) and individual components [49]. A temporal component can be calculated within the limits of predefined time or in any particular time of the day. The overall accessibility measure is developed with respect to transportation and activity components.

The wider range of rural-regional socioeconomic problems, including higher mortality rates, illiteracy poverty, dilapidated trade and agriculture infrastructure erupted because of the absence of transport-related facilities and infrastructure [50-53]. Accessibility and land-use can be considered as important tools for the revitalization of urban and backward regions [54-59]. Transportation accessibility helps rural people in accessing their opportunities efficiently in time. Through the provision of low-cost transportation facilities and proper road connectivity, the rural population becomes more accessible and more prosper. The rural population

can access their basic needs and complete their activities in time, which can put positive effects on the whole socioeconomic structure of destitute sub-regions [60,61].

7. CONTRIBUTION AND RESEARCH GAPS

This review study contributed the existing knowledge and answered the following research questions:

- (i) How transport planners can be beneficial in the development process of depressed sub-regions?
- (ii) How transportation planning can flourish the rural regions and abridge gaps regarding their socioeconomic growth?

In addition, this study also clarifies that how transport decision-makers can execute policy proposals and different models to mitigate the transport-related bottlenecks of rural inhabitants. With the help credential transport availabilities, the interaction between destitute sub-regions and urban settlements in the developing counties can be consolidated, which seem inevitable for the growth of socioeconomic sectors. The accessibility issues can be reduced and transport flows can be enhanced in this way, which can improve the living standards of rearward societies. This study can help transport planners and development authorities to plan for the better accessible future, where different rural activities could be accomplished efficiently. The urbanization process can be curtailed in this way, which can balance the availability of resources equally for urban as well as rural settlements.

To propel the socio-economic development in depressed sub-regions, this study recommends the policy proposals, which can be reviewed hereafter. The policy guidelines emphasize on the accessibility standards of rural households.

7. PROPOSED POLICY IMPLICATIONS

Rural households visit many destinations daily or weekly as needed (e.g. work sites, local markets, and health or education facilities). In a rural environment, these facilities should be evenly placed alongside the roads with rural settlements at one end as shown in Fig. 4. Sparsely located activities required more travel to reach them. If the destinations are located in close proximity, these could reduce the average travel time and distance, and even be reachable by walk. Therefore, increase in a number of local markets, employment opportunities, and health or education facilities, according to standards tends to improve the accessibility. At the same time, short distances can increase the travel options available to the rural population, particularly walking.

Litman [62] proposed that accessibility standards could be increased, if facilities located close together as shown in Fig 4.

In Fig. 4, destinations are located close together along a roadway, which could increase accessibility. If

destinations are close enough together, these can be easily reached by walking, which is suitable for rural sub-regions, where most of the people do not have their personal vehicles. In the same way, the center of a road link can reduce the average distance to each destination, which ultimately increases the accessibility as shown in Fig. 5.

A more central location reduces travel requirements, which can increase accessibility. Rural settlements with proper road connectivity can improve the accessibility standards of their residents. Every rural settlement has the road facilities, which provide basic access for the completion of routine activities. If markets, commercial centers, employment locations, health and education facilities would be provided along both the ends of the rural settlements as shown in Fig. 5, it could enhance the accessibility and improve the transportation flows. It is foreseen that accessibility standards can be increased in this way, which could inject socio-economic development within deprived rural sub-regions.

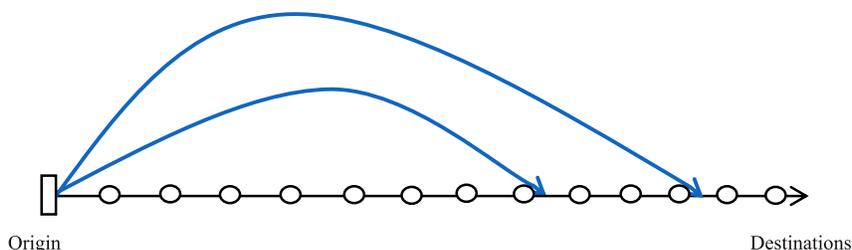


FIG. 4. ACCESSIBILITY FROM A LOCATION AT ONE END OF A ROADWAY

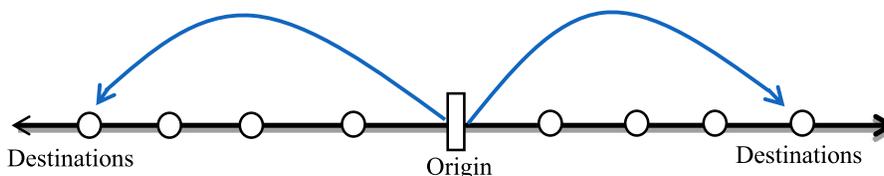


FIG. 5. ACCESSIBILITY FROM A LOCATION IN THE CENTER OF A ROADWAY

8. CONCLUSION

Regional transportation planning is a key determinant in the development of rural regions of the developing world. The transportation sector provides connectivity to rural inhabitants, as they can serve their lives in a better way. Rural inhabitants need transportation services and facilities to fulfill their daily needs, including access to market, health, education, commercial centers and regional prominent settlements. The aim of writing this review article was to propose policy guidelines, focusing accessibility-related issues of rural households, living in depressed sub-regions of developing countries. Further, this study was also articulated to seek and deliver knowledge about the rural transport sector and its importance with respect to the planned development of rural sub-regions. This study is a part of the literature review conducted to provide transportation policy solutions to the destitute sub-regions of the developing countries. This review paper can provide a bunch of information to the readers about the regional transportation problems in the deprived rural regions. At the same time, this study unleashes the ideas that how transportation problems of the rural dwellers can be mitigated efficiently, which is almost seventy percent of the total population of developing countries. Moreover, to fulfil the aim of this study, and to eliminate the transport-related problems of rural households, policy proposals were suggested to improve the accessibility criterion of the rural population. This should also be noted that suggestions or policy plans should be revised time to time, to answer the emerging issues of rural inhabitants.

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