NTNU
Kunnskap for en bedre verden

CANDIDATE
10058

TEST
AAR4843 1 GIS-metoder for samordnet areal- og transportplanlegging

Subject code	AAR4843
Evaluation type	Hjemmeeksamen
Test opening time	10.05.2022 13:00
End time	10.05.2022 17:00
Grade deadline	02.06.2022 21:59
PDF created	10.05.2022 17:40

Front page

Question	Question title	Question type
ℹ	Front page	Information or resources

Question 1

Question	Question title	Question type
1	Question 1	Essay
2	Eventual upload of illustrations	Upload Assignment

Question 2

Question	Question title	Question type
3	Question 2	Essay
4	Eventual upload of illustrations to question 2	Upload Assignment

Question 3

Question	Question title	Question type
5	Question 3	Essay
6	Eventual file upload to question 3	Upload Assignment

1 Question 1

The county council decides that nobody should have more than 45 minutes travel time from an emergency center (whether in an ambulance, a fire truck or a private car).
How will you go about finding out where this requirement is not maintained today?
Assume you identify large areas where the travel time is longer than 45 mins., and also assume that no emergency centrals should be moved or removed - you can only suggest new ones. How could you find and assess suitable locations for new centrals?

Fill in your answer here

The given question can be answered by creating an accessibility map for the county so that the areas that do not have accessibility to emergency centres within 45 minutes can be located. The accessibility mapping can be done using the closest facility network analysis tool, and would require a car network data for the county, the locations for the emergency centre as point feature class, and a gridpoint data for the county, which could be created by dividing it into a fishnet (of say 250m) and using the centres of the squares of the grids as the point data. We run the analysis with the emergency centres as facilities and the gridpoints as the incidents. After running the analysis we can create the accessibility map by changing the symbology and can point out the areas where it takes more than 45 minutes to reach the emergency location and where it doesn't.

To find out the best location for the new centre, I would suggest the use of OD Cost Matrix with travel time weighted by the population, to find out not only the centres that serve the county in less than 45 mins, but also serve a significant amount of the population. We would require a car network data and population grid data for this analysis.

I would first randomly select points close to the areas that have low accessibility to the existing centres, and these points could be the possible areas where the new emergency centres can be located. I would then run the OD Cost Matrix and use population data for the region to calculate a weighted travel time to the points. Based on the results, I would select those regions that have the least weighted average travel time for all the large regions that were uncovered by the existing centres previously. After selecting the locations for new emergency centres in the large areas where travel time was more than 45 mins earlier, I would recheck and create the same accessibility map using the old and new locations together to see that all areas have been covered for the given cutoff time.

The reason I chose to weigh the travel time based on population is because setting up new emergency centres is expensive and thus it makes sense that we should have the new centres that serve a good amount of the population in the county. Also, 45 is the highest limit, and hence our planning should be such that the centres are accessible to maximum people in the minimum possible time.

2 Eventual upload of illustrations

In case you have made illustrations or sketches to question 1, upload here.

Upload your file here. Maximum one file.

All file types are allowed. Maximum file size is **50 GB**

Select file to upload

3 Question 2

The urban region where you work as a planner is considering a restructuring of the entire public transport system. Among the measures they are considering is to increase the distance between the stops (so that the vehicles can increase the speed), increase the bus frequencies during rush hours, but reduce the frequency during evenings and weekends. Assume you have GTFS-files describing both today's PT system and the suggested future one. Assume also that you have a pedestrian network and detailed information on the population (age, gender, address) and the land use/activities.
You are going to assess the suggested changes with respect to accessibility, both for the population in general, and for specific groups among the population (such as elderly people). How could this be done?

Fill in your answer here

Public Transport system is special as it is something that cannot have a defined speed but rather runs on schedules and frequencies. Hence the basis of its analysis and assessment should also be based on different factors so that It covers the accessibility at all the different times. Walking Time (Depending on stops) and Waiting time (depending on frequency) are important factors in determining the overall accessibility of the Transit. My assessment would be based on the changes that are planned, an increase between the distance of stops, and changes in the frequency.

Using the GTFS Files and the pedestrian network, I would first create two different PT service networks, one with the current PT system and the other with the new suggested Pt system to build a comparative basis for my analysis. I would create a schedule aware public transport network which would be created on ARCGIS using the transit network template by ESRI. This PT network would give us the total transit time, along with the walking time which could be used for making our assessment.

It is necessary that we try to point out on all four components of accessibility (land use, transport, temporal and individual) in our assessment of the new PT System.

Based on the newly created PT Networks and Pedestrian Network, I would first assess the pedestrian access to the bus stops. As the PT network is an extension of a walking network, it makes accessibility to bus stops really important to judge the overall accessibility of the PT system. I would check if the new bus stops do not have a very long walking distance for the people in the municipality. This could be done by using the closest facility function with the bus stops as the facility and for the population gridpoints as the incidents.

I would also use the age data to further check if the bus stops are accessible by the elderly and children by filtering out the total population data based on age,(as these groups walk slower than the general population).

For this, I could either create a new pedestrian network with a slower speed or could estimate by lowering the cutoff for what is considered good accessibility.

After the location of bus stops has been assessed, I would further check the accessibility to basic services (like grocery stores) for different time periods, one where the frequency is high, and one when it is low (Weekends and evenings). This could also be done by the closest facility function and a comparison could be built between the old and new network at different times of the day to observe if certain regions are cut off or have very long waiting times because of lower frequency in non-peak hour and weekends.

Since detailed data is available for land use and activities, I would further select areas where people travel during the weekends and evenings to check their accessibility to them (Like hiking spots, restaurants, big shopping centres like IKEA). This needs to be done so that public transport does not stay restricted only to work trips and people without a car don't have extremely long waiting times during the non-peak hours. I would also see the walking distance of the new bus stops from these locations as they too have been reduced in the new plan, and should not have very long walking time.

Although I would compare all analyses between old and new systems, but a detailed check would also help to point out those areas that were ignored before and were not considered during the planning of the new PT system. By the mentioned ideas above, I try to cover all aspects of accessibility by creating a PT network and comparing a change of accessibility with new and old networks at different times, for different people and for different locations.

4 Eventual upload of illustrations to question 2

In case you have made sketches or illustrations to question 2, upload here.

Upload your file here. Maximum one file.

All file types are allowed. Maximum file size is **50 GB**

Select file to upload

5 Question 3

We have created an ABC-analysis / ABC-map during this course, and enabled ourselves to suggest and discuss localization of urban functions. But the method in itself has some weaknesses. Could you elaborate on these weaknesses, what kind of errors or inaccuracies are we introducing if we use the ABC method? Perhaps you also could suggest ways to improve the method?

Fill in your answer here

The ABC analysis is performed to have "the right business in the right place". We used the Norwegian variant of the ABC analysis principle to create the maps where all areas in the municipality were classified as A, B, C and D areas and the focus on accessibility was by bus, bicycle and freight. Areas are classified based on the selected modes of transport (A- areas have very high PT Accessibility, B- areas have high to medium accessibility by PT and bike and are within 300m from a high-frequency bus stop in rush hours, C-areas are within 1000m of an intersection of roads with high standard).

The policy helps us mark out the areas based on specific accessibility, to localize selected services and mobility for the targeted population.

Although it is considered a "best practice", but is not free from limitations.

As the policy uses bicycle and PT accessibility for the mapping, there is little consideration for walking which is also an important sustainable mode of mobility. Walking is only partially considered, as it is a part of public transit networks, while we see it is an important mode of transport as it has comparatively maximum trips among the three sustainable modes based on National Travel surveys.It can also be problematic to use for travel modes with a limited range like bicycling and walking as some local centres might get missed.

One suggestion to improve this is to have realistic cut-offs decided for these modes while creating the accessibility maps. This would help out identify the local centres for bicycle accessibility. Walking too could be included with a realistic cut off in the A areas so that it does not stay limited to PT accessibility.

The suggestions for where the right businesses and other services should be are comprehensively defined, but there is no recognition for where the residential areas should be. A suggestion to improve this would be to have it close to areas where there is general overall good high to medium accessibility to PT networks and other sustainable modes of transport . This is necessary as if we want more and more people to switch from cars to these modes of transport, the first thing should be that they are readily available in locations where people live, otherwise, car dependency will continue to stay.

There are also no defined "rules" on what should these areas be, and the cutoffs are usually selected by the planners themselves. Hence, it is necessary that the context of each city or region should be kept in mind while creating the ABC Maps. Also, with no defined rules, planners have a huge role in defining what area should be placed where, which can influence decisions and hence calls for more transparency for the selection.

As it is difficult to define a set of rules for such analysis (as it may vary for city to city), there should be a series of check, if possible by different institutions to propose their version of the ABC map for the area so that different perspectives could be understood and the best possible mapping could be created that is free from biases.

There are also a few technical limitations while using the ABC Map. OD Cost Matrix calculations with very high resolutions are slow and time-consuming. A lower resolution grid could be used if high-speed computational capacities are not available.

When calculating accessibility for a municipality, local centres with good accessibility may be missed out on the bigger picture. Hence there should be a manual understanding on what areas are important in the city, and this makes the planner's role as a rational thinker more important.

6 Eventual file upload to question 3

In case you made skethes or other illustrations to question 3, upload here.

Upload your file here. Maximum one file.

All file types are allowed. Maximum file size is **50 GB**

Select file to upload