

Improving the Performance of Airport Service Cars Using Mobile GIS

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Abstract. Despite the traffic increases at the World airports, little works have been done to improve vehicles and airplanes services, increase efficiency and decrease service automobile voluminous of large number. With GIS abilities, airport managers would like using its potential for development and management of airports. So new issue in GIS is formed with Airport GIS (AGIS) title to study GIS applications in airport as wide and corporation all world airports and GIS specialists.

The main innovation of this research is to offer a spatiotemporal data analysis and introducing an efficient algorithm for service automobiles allocation optimization with reduction in departure time deferment constraint. Allocation has been done by considering the two parameters include push and tow time of aircraft and its distance to the service car. In this proposed solution servicing operation optimizes with considering two situations. Numerical results of using proposed method in Mehrabad international airport indicate in both situations, departure delay is lesser than usual method. Outcomes of minimizing service cars are: traffic reduction, increase management efficiency, decrease hazards due to large number of service cars and increase safety in airport field.

Keywords. Airport GIS, Pushback tractor, Airport, allocation

1. Introduction

Nowadays airport analyzers and engineers come toward GIS to support their efforts in planning, operation, maintenance, security with adding spatial information and modeling and use its potential in airport development and management [1]. So new issue in GIS is formed with AGIS title to study GIS applications in airport as wide and corporation all world airports and GIS specialists [2].

Increasing the number of airport flights causes the need for increasing in number of airport service cars. Increasing the number of service cars causes: increase in possibility of accidents, safety reduction, decrease operational efficiency and consequence decrease management efficiency [3].

One of the most important and expensive service cars in airport is pushback tractor that Mehrabad airport face to leakage of this car. For respond to

pushback tractor leakage and its outcome that increase number of airport service cars one effective solution is allocation optimization.

2. Modeling

Push and tow service is one of the several services that is serving to airplanes. In this service the push back tractor does carry the airplane from apron to taxiway. There are other services in airport. For example, there are passenger and cargo transport service, air condition service, lavatory service, water service and fuel service. These services could be done in two situations: 1) In this case service car must be return to its EPA. Fuel service operates like this situation.

2) In other situation service car after did service, can be go to ESA and park there. The air condition service could be move between all of airplanes and serving to their without returning to EPA. Pushback tractor spends time for travel form its station to aircraft station. Pushback tractor through push and tow operation transmit aircraft to taxiway. Push and tow procedure is dependent on distance from the plane to taxi and the traffic around. After transferring aircraft to taxi way, aircraft goes to runway and push back tractor returns to its EPA. We illustrate our proposed method in the figure 1 that includes total steps of solution.

$$\min \sum_{i=1}^m \sum_{j=1}^n \sum_{k=1}^o \sum_{l=1}^u ((Ts_j^i + \frac{d_{kl}}{v_{kl}} + tp_j^i + A) - Td_k^i) x_{ij} z_{jl} y_{ik}$$

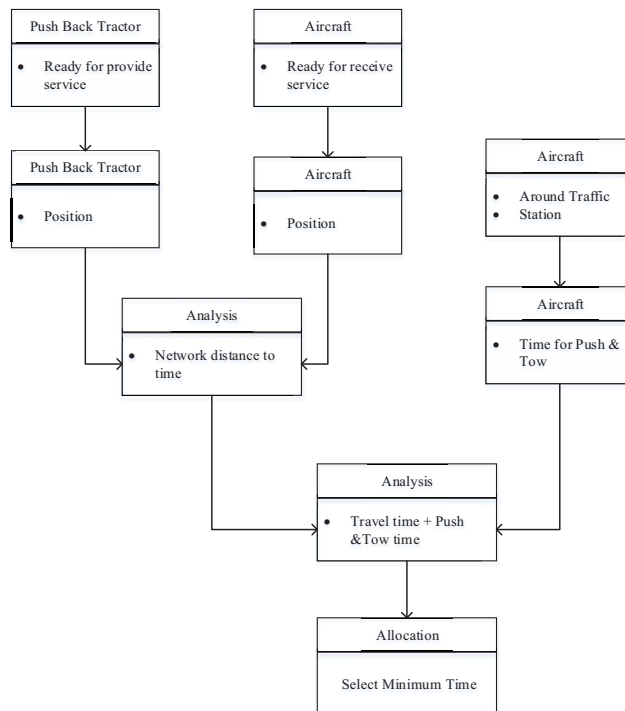


Figure 1. Steps of proposed model

3. Implementation

For implementing one of the traffic pick hours at Mehrabad airport has been considered. To evaluate the proposed method, we implement conventional methods at the airport for mentioned flights. Figure 2, 3, 4 shows the process of allocating pushback tractors to aircrafts.

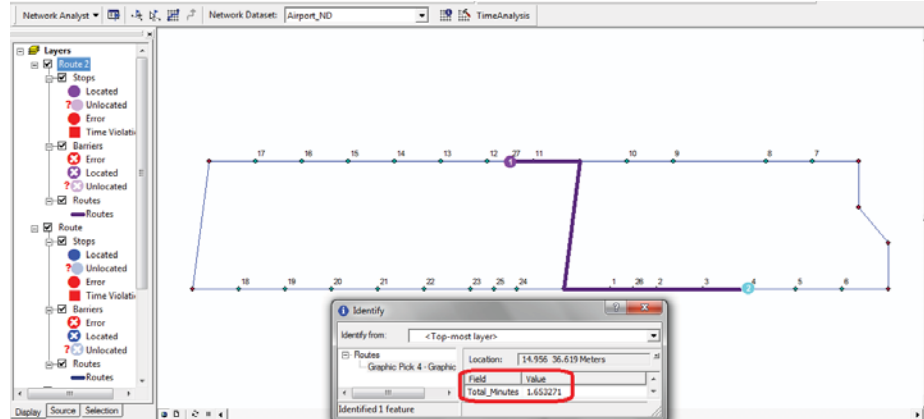


Figure 2. Calculation of network distance time for 4 and 27 stations

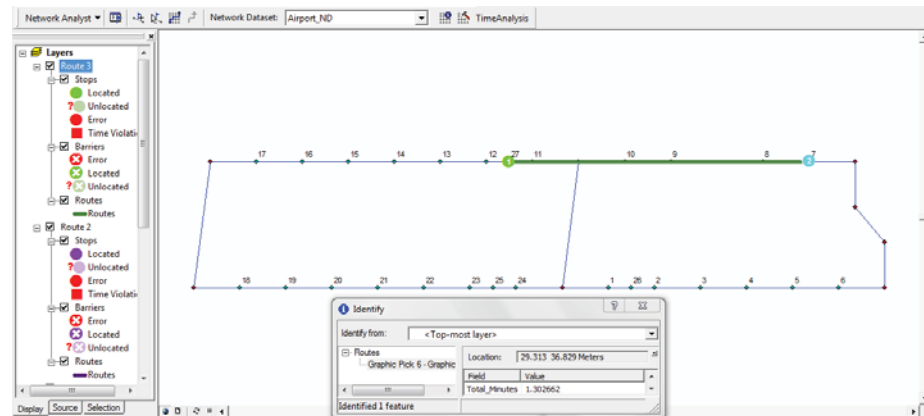


Figure 3. Calculation of network distance time for stations 7 and 27

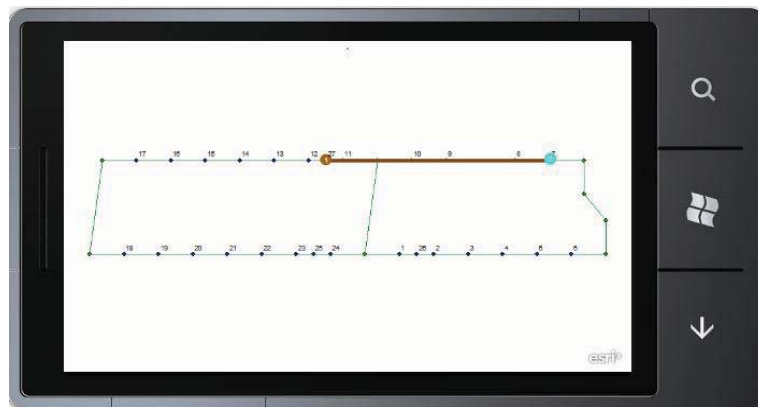


Figure 4. Informing pushback tractor to service the aircraft at station 7

Table 1 shows Comparison results of using usual method and proposed method if pushback tractor returns to EPA.

Table 1. Comparison results if pushback tractor returns to EPA

if pushback tractor returns to EPA	total delays
usual method	15.5min
proposed method	8.5min

Table 2 shows the total delays time using proposed and conventional method if pushback tractor returns to ESA.

Table 2. Comparison results if pushback tractor returns to ESA

if pushback tractor returns to ESA	total delays
usual method	7.5min
proposed method	3min

4. Conclusion

Increasing in airport traffic, force airport managements found solution that increases their management efficiency. In this article a new optimization method is suggested based on minimizing number of service cars with considering time conditions and constraints. Leakage of pushback tractor due to its high expenditure is reasonable cause for allocation optimization of this vehicle.

Optimization has been done for two situations. Using proposed method, the total delay times improved. To evaluate the proposed method, the usual method was applied. Comparison of results shows the proposed method will be has less delay in all conditions. Optimal allocation reduces traffic, increased safety, improve service operations and reduce costs.

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