INTEGRATION RAIL CONNECTION SILESIAN AGGLOMERATION WITH KATOWICE – PYRZOWICE AIRPORT

Sylwester Markusik, Maria Cieśla
Higher School for Strategic Planning, Department of Logistic, Dąbrowa Górnicza , Poland

Abstract

In the closest time, the basic transportation task on the Upper Silesia (Poland), will be fast carriage passengers from main cities of Silesia Agglomeration to the International Airport Katowice- Pyrzowice. The Silesia Agglomeration have over 3 mln citizens and composed from 14 cities, located on west - east and south - north directions of region. For today the Airport is only achievable by cars for passengers. In the article will be presented results of researches, realized during 2009 year by private management and university consortium, that consider new railway connection between main cities of Upper Silesia Agglomeration and local Airport. The article will be shown technical problems with how to choose right transportation version with airport, that will be realized in practice, from many propositions and alternatives.

Keywords: integrated transport, traffic network, density of traffic.

1 Introduction

Bigger and bigger transport needs in Upper Silesian Province cause that public passenger transportation may become a basic of a good functioning transportation system. Unfortunately, recently systematic fall of passenger transports in public transportation was observed. Growing number of cars and their frequent use in everyday trips are the basic reasons of passengers' departures from public transport. Lower and lower "transport standards" offered by public transport are also significant in this issue.

2 Silesian transport integration

There is a big necessity of communication integration of Upper Silesian cities Agglomeration with rail connection integrated with tram and bus system. The communication integration of cities in Upper Silesia Agglomeration should be based on railway line creation, adapted to carry a new type of quick tram, which is often called "railbus". Rapid City Rail (*pol. Szybka Kolej Miejska* - SKM) should as much as possible the existing infrastructure of Silesian rail haulage (tracks, flyovers, embankments and excavations).
The problem of communication system integration on Silesia is not a new issue. Over the years there has been a few concepts of connection of the 14 cities which form Upper Silesia Agglomeration with dynamic developing Katowice – Pyrzowice International Airport (fig.1), which so far is only available by car [3]. In all the concepts mentioned, the aspect of passenger transport integration with other cities of Agglomeration towards the Airport in Pyrzowice, was omitted. The possibility of Bytom and the cities to the west of Bytom (Gliwice, Zabrze) connection to the rail system connection with Pyrzowice Airport hasn't also been considered. The new SKM rail system solves the problem of intercities communication in Silesia comprehensively and also ensures a fast connection of all big cities of the Agglomeration with Pyrzowice Airport [5].

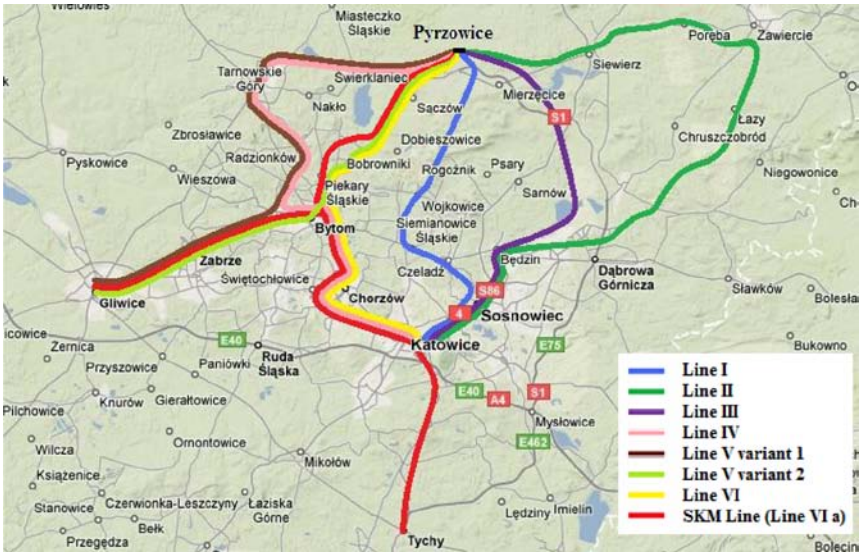

Figure 1 Possible connections of Upper Silesia Agglomeration with Katowice Pyrzowice International Airport

SKM Rapid traffic line in Agglomeration is basically designed for massive passenger and/or traveler traffic service, along lines of central located cities in Silesian Province: Gliwice, Zabrze, Bytom (line 1, fig.2) and Tychy, Katowice, Chorzów, Bytom (line 2, fig. 2), then through Piekary Ślaskie, along A1 highway to Katowice – Pyrzowice International Airport.

Optimal railway connection of Katowice Pyrzowice International Airport with Upper Silesia Agglomeration must have fulfill two basic functions:

1 Express airport connection function: enables direct and express passenger transport from towns of: Gliwice, Zabrze, Bytom and Piekary Śląskie and Tychy, Katowice, Chorzów to Katowice Pyrzowice International Airport and also indirect passenger transport from other neighboring with SKM line cities (ex. Slemianowice Śląskie, Ruda Śląska, Tarnowskie Góry) (fig. 2).

2 Agglomeration transport function: enables direct passenger transport from any place situated in the Upper Silesia Agglomeration cities to significant places situated in downtowns of these cities or the neighboring ones, to workplaces, malls, recreation, religion and other places,

Choice of the optimal Rapid City Rail (SKM), according to the determinant factors, the following should be itemized [2]:

- exploitation of already existing rails, tram rails and closed or weakly utilized industrial rails, normal and narrow-gauge rails in a maximum degree,
- localization of the new sections of the line by relatively shortest way on the grounds which possession status will not be conflict,
- the time and comfort in express traffic of the travel to Katowice Pyrzowice International Airport should be competitive according to the present time possibilities of traveling by car or bus (max. 40min),
- a special ticket must be planned (with different tariff) for agglomeration and express communication for SKM trains and crosswise connections

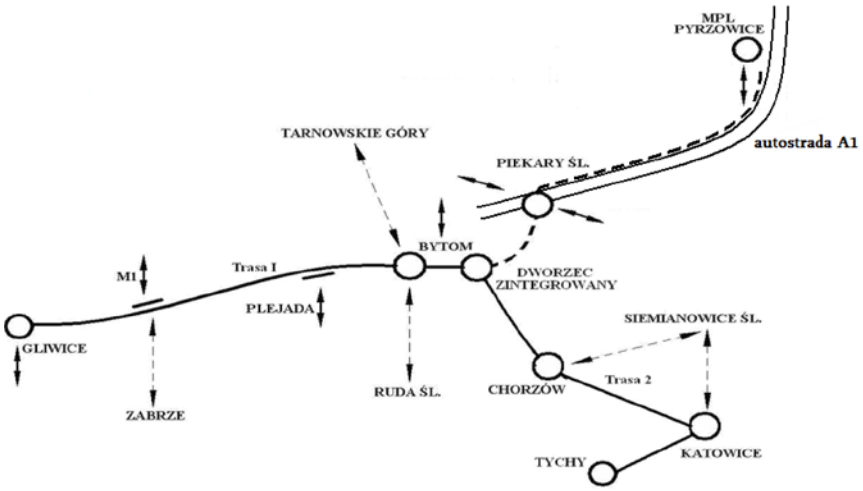

Figure 2 Integration of railway connections (line 1 and 2) towards airport

In order to fulfill all the established functions, the SKM railshould have following technical parameters [5]:

- line 1 and 2 length (fig.1) ca. 44km, there 31km on already existing rails,
- average capacity ca. 2000 persons/hour,
- max speed in a express traffic, in unbuilt area max 160km/h,
- average speed in urban district ca. 30km/h,
- postulated average communication speed ca. 50km/h,
- mean of transport (tram or railbus) in express and agglomeration traffic.

3 Silesian transport integration

According to the SWOT analysis for All the Wight variants of lines (fig. 1), regarding shortest distance and passing through relatively law urbanized areas, line VI was the optimal connection of Upper Silesian Agglomeration with Katowice Pyrzowice International Airport [3]. Nevertheless, after environmental influence analysis, the line happen to pass through *Nature 2000* areas. That is why the original concept and moving the line to Bytom, where lines 1 and 2 join (line Via – fig. 1), had to be done [2, 5].

In the area of Bytom borough, the SKM line may be executed with three variants, according to the possibilities of line 1 and 2 junction:

1 Variant I, where line 1 (from Gliwice side) and 2 (from Katowice side), join together on Integrated Station: Bytom – Pogoda (fig. 3),
2 Variant II, where line 1 and 2 join together on changing point Bytom – Obwodnica (fig. 4),
3 Variant III, where line 1 and 2 join together on Station Bytom – Arki Bożka (fig. 5).

In variants I and III, the junction of the lines will be on Integrated Station, where there will be integration with rail traffic of the following means of transport (fig. 6):

- city buses,
- intercity and international buses,
- trams,
- individual means of transport.

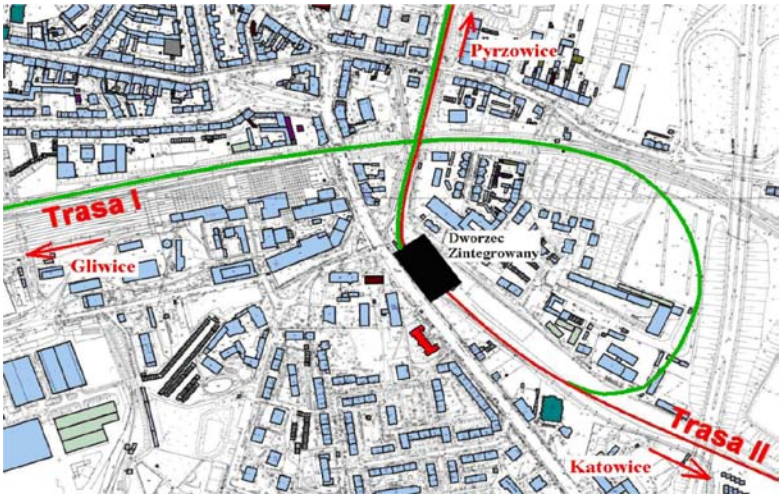

Figure 3 Variant I of line 1 and 2 junction [5]

Figure 4 Variant II of line 1 and 2 junction [5]

Figure 5 Variant III of line 1 and 2 junction [5]

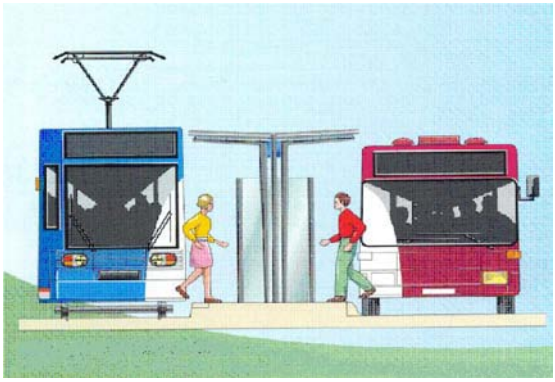

Figure 6 The idea of Integrated Station

On the area of stations of this types there should be box offices, waiting-rooms, market and service points, ticket machines etc. Around the station there will also be: parking (park and ride type), bus station, tram station and taxi stop.

4 Further analysis variant selection

The selection of one of the three variants of line 1 and 2 in Bytom junction was made basing on the expert methodology, which establish assessment of an issue by independent expert/experts, where the influence of external factors on the given solution reality [1] (fig.7). The experts are chosen in the area of science, social, industry and territory governments (but with a number of max 10 people).

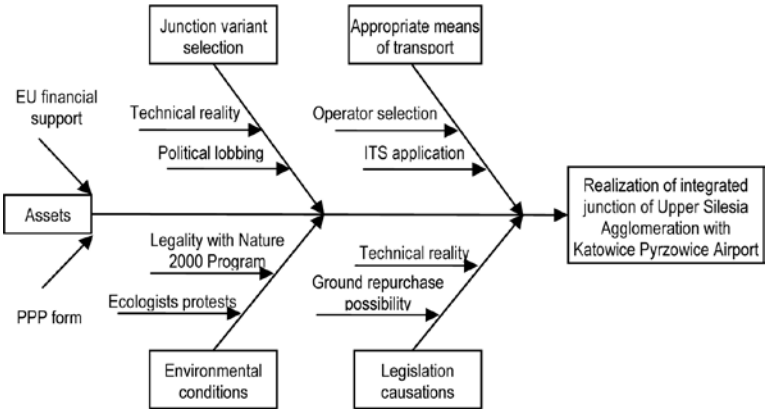

Figure 7 Cause and effect graph of Upper Silesia and Katowice Pyrzowice Airport junction variant selection ("Fish bone" Ishikawa graph)

The selection criterias were divided because of their importance (attractiveness) and feasibility. According to the importance of each junction variant, economic, social, environmental importance and ability of new functions by the new junction, were selected. According to the feasibility, application and practical potential of each variant were taken into account. The scheme of specific criterias to the main criterias is presented on fig. 8.

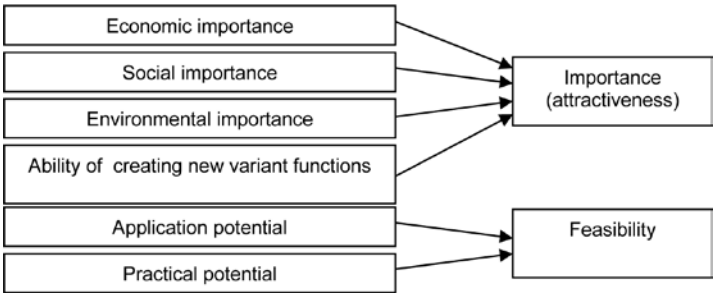

Figure 8 Importance and feasibility of variants criterias

To ascribe appropriate rang for each criteria, when assessing the variants in 1 to 5 scale, where 1 is a low importance of each criteria, and 5 adequately it's high importance, after taking the average of the experts assessment, the results would be as presented in tab. 1. The same assessment could be done when regarding the experts opinion (e. g. basing on Delphi questionnaires) or solving the assessment matrix.

Table 1 Communication variants assessment matrix

Variant	Communication variant assessment criterias						Total points number
	importance				feasibility		
	economic	social	environ-mental	new functions creating	application potential	practical potential	
I	4	5	2	5	4	3	23
II	4	3	2	3	3	3	18
III	4	3	1	2	4	3	17

To define assessment criterias of the variants according to their usefulness only for Bytom town, than for the same assessment scale, the ranking could be a little bit different (tab. 2).

Table 2 Usefullness (attractiveness) characteristics of variants for Bytom [5]

Assessment criteria	Variant I	Variant II	Variant III
Road availability from Bytom downtown to other cities	4	5	2
Trade attractiveness	5	1	2
City-creating functions	5	1	3
Ground possessive rights	3	2	4
Parking possibilities	4	1	3
Passenger comfort	5	2	5
Investing expenses necessity	2	3	4
Compatibility with Nature 2000 Program	5	5	3
Environmental influence on citizens surroundings	2	3	4
Houses ruining	3	1	1
Each variant realization by PPP	5	1	2
Integration with other means of transport ability	5	2	2
Ability of realization of the appropriate R Turing diameters of the rails	4	5	1
Total points number	52	32	36
Citizens expectations realization degree [%]	80	50	55

In the method presented in tab. 2, of each communication from Katowice and Gliwice side to Bytom and further to Katowice Pyrzowice Airport communication variant assessment and ranking it is obvious that variant 1 has most advantages. Taking into issue the biggest profits for Bytom town, the III variant also presents many advantages with definite elimination of variant II. Although the subjective assessment of the three communication of Katowice and Gliwice junctions with Katowice Pyrzowice Airport, the I variants seems to be the most profitable with the highest degree of citizens expectations satisfaction.

5 Communication preerences and traffic increase research

The research was supposed to bring information about communication preferences of people travelling to Katowice Pyrzowice International Airport, but most of all to bring knowledge about readiness of using the rail connection with Upper Silesia Agglomeration. The questionnaire results of readiness of using the rail connection were presented according to the groups of people with similar travelling behaviors, who are from:

1 cities located in Upper Silesia Agglomeration,
2 other cities of Silesian Province,

3 cities outside province.

Average readiness of using the rail connection for population examined together with a companion of the travel would increase the preferences about travelling to airport, but only when it would be a high quality rail connection. It concerns especially people leaving in Silesian province, but also outside Upper Silesia Agglomeration (tab. 3).

Table 3 Readiness of using the rail connection

Residence region	P.Q[1]	P. T.[2]	Absolute			Realtive		
			Yes	No	Don't know	Y	N	DK
Upper Silesia Agglomeration	59	2,0	33	22	4	55,93%	37,29%	6,78%
Other cities of Silesian Province	48	2,1	27	19	2	56,25%	39,58%	4,17%
Cities outside province	97	2,9	70	20	7	72,16%	20,62%	7,22%
Total	204	2,4	130	61	13	63,73%	29,90%	6,37%

[1] - P. Q. – number of people questioned and company travelling
[2] - P. T. – average number of people travelling to airport with person questioned

Passenger traffic on Katowice Pyrzowice International Airport during the nearest years will regularly increase about 10 – 20 % yearly (fig. 9). It means, that also the number of passengers of the rail connection planned will regularly increase within the years. It is estimated that average will not be bigger than 50% of people from Upper Silesia Agglomeration travelling to airport will be the ones who would choose the rail connection [3].

There were following establishments for passenger traffic prognosis study on Katowice Pyrzowice International Airport in the years 2012 – 2015 [5]:

1 2006 is the initial year with daily traffic intensity coming to Katowice Pyrzowice Airport about 4612 people/day [3],
2 the increase of passenger traffic will be about 12% per year, which makes 12 000 people/day in 2012 (4 320 000 people/year – fig. 9),
3 about 50% of this number would be ready to use rail transport connection – that is about 6 000 people/day,
4 63 % of travelers would come from west and south side, which is about 3 800 people/day in 2012 (and the same passenger traffic would occur in the returning direction)

The passenger traffic prognosis (drives) on the whole line, connecting Upper Silesia Agglomeration with Katowice Pyrzowice Airport can be presented as on fig. 10 (Sankey graph). The same flow of people will be travelling on the opposite direction from Katowice Pyrzowice Airport to the cities of Upper Silesia Agglomeration.Pasenger flow in the "airport" (express) version to Pyrzowice may be realized by FLIRT traction set (made by Stadler), connected together from Katowice and Gliwice side on Integrated Station in Bytom. Time of a train travel from Katowice is about 35 min. and from Gliwice – 40 min.

6 Conclusions

- Increasing passenger traffic between cities of Upper Silesia Agglomeration and Katowice – Pyrzowice International Airport implicate necessity of building a new independent from road transport, rail connection.
- Optimal line connecting Upper Silesia Agglomeration with Katowice – Pyrzowice International Airport must also consider local communication traffic needs and requirements of the environment.
- Localization of SKM line proposed in utilizes 70% already existing or closed elements of rail infrastructure, within actually exploiting 46% of rails.

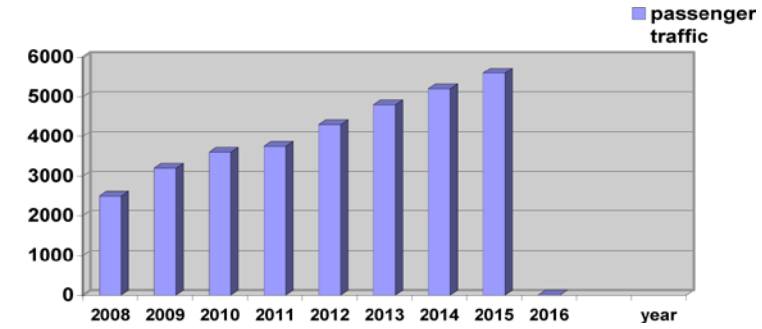

Figure 9 Pasenger traffic increase prognosis in katowice Pyrzowice Airport [4]

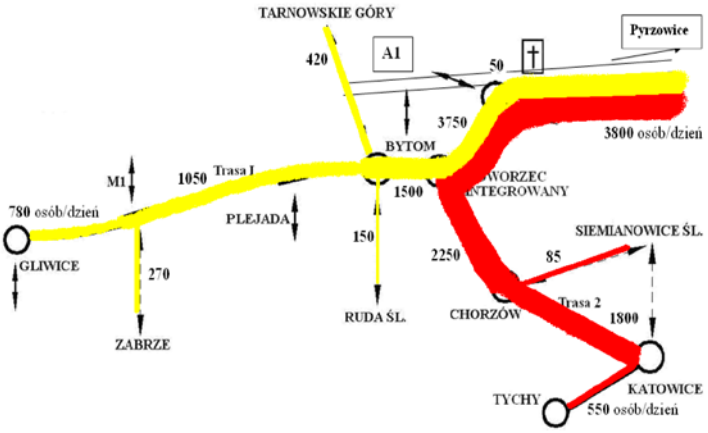

Figure 10 Passenger traffic intensity prognosis on the line from Katowice and Gliwice to Katowice - Pyrzowice International Airport in 2012 year

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