# THE INFORMATION SYSTEM MODEL OF THE INTEGRATED INTELLIGENT PASSENGER INFORMATICS SYSTEM

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## Abstract

The passenger informatics systems are those transport informatics systems, which are used in the public transport connecting to the passenger transport processes. The experiences gathered in this field show that the till now quick pace of the development is followed nowadays by a forth increasing pace. The advanced telecommunications solutions widen the transport informatics towards transport telematics. The developments by using the instruments of the telematics in the field of the passenger informatics systems take place by this time in the field of the co-ordination, building together of the systems. As a result of all of it, the integration covering the whole information system of the passenger transport appears these days already as a real aim. The result of it is the *integrated intelligent passenger informatics system.*

In the integrated system it is becoming possible, to execute the information supply tasks in advanced manner by providing of the *value-added information*. This information can be constituted by using the basic information, by processing of the additional information coming from the other systems, by application of the artificial intelligence represented by the computer algorithms.

The aim is in this presentation to summarise all of the knowledge, that is needed to understand on the level of modelling the information system structure of this new solution, which does not exist nowadays in full building up yet. The information is to be filed in an integrated database, that is a precondition of the integrated system. To organise the operation of the system properly, we have to overview the structure of the database.

## AIMS OF THE MODERN PASSENGER INFORMATICS SOLUTIONS

The **passenger informatics systems** either supply only information for the passengers or execute additionally other functions connecting to the travelling (i.e. seat reservation). In accordance with it, the two main groups of the passenger informatics systems are:
- the passenger information systems and,
- the passenger serving systems.

The systems can be grouped further by the following aspects:

- type of connection to the process of change of place (direct or indirect),
- extension regarding the subsectors (unimodal, multimodal),
- the time permanent feature of the supplied information (static, semi-dynamic, dynamic),
- use of value-added information (conventional, value-added service),
- the range of the users (collective, individual service).

The passenger information service has to cover the whole process of change of place both in space and in time. To carry out it, the service have to be place independent, range from house to house and consider the changing possibilities. The passenger information service has an important role in the passenger transport management. The information supply, the influencing of the passengers behaviour concerning the transport mode are very significant both before and during the travelling. They have traffic regulation functions. [1].

## LOGICAL ORDER OF THE SUBSYSTEMS

First it is needed to overview the subsystems and their functions. The classification of these systems is possible by the features of the realised hardware solutions, the used software and in the sequence of process of change of place (travelling) as well. We act most properly, if consider the *process of change of place* (travelling) as a main principle at putting the systems in order, seeing that the basic process, say the elements, logic of process of change of place between the origin and destination points is steady.

Following the process-oriented principle, the passenger informatics systems can be classed among three groups. Mostly the transport companies' other information systems give the data for operation of the passenger informatics systems. Therefore the informatics systems for planning, account and control functions also have to been integrated. The mentioned six groups of the subsystems and the certain systems can be seen on Figure 1. [1],[2].

## METHODOLOGICAL ISSUES OF THE MODEL CONSTRUCTION

The transport systems - consequently the passenger transport systems as well - can be built up from the following components: [3].
- function structure,
- transport basic process static structure,
- transport basic process dynamic structure,
- transport control process static structure,
- transport control process dynamic structure.
In the passenger transport systems the mentioned components work together for the sake of the pre-defined causes. The function structure means the main functions of the transport system and their connections to each other. The aim of the transport system is to execute these functions. The static structure of the transport basic process consists

**6.**
**PASSENGER TRANSPORT CONTROL MANAGEMENT**

Upper management level

Middle management level

Operative control level

| 61. Transport Influencing Factors Information **(TIFI)** |
| 62. Operative Planning of Capacity Exploitation **(OPCE)** |
| 63. Operative control **(OC)** |

**1. PLANNING OF THE PASSENGER TRANSPORT**

Planning of prospective demands | Planning of capacity (capacity change) | Planning of capacity exploitation

Planning of transport tasks | Planning of immobile components | Planning of mobile components | Planning of transport basic process

11. Demand Assesment, -Analysis, -Planning **(DAAP)**

12. Transport Network Planning, Service Planning **(TNPSP)**

13. Vehicle strength, Work-force, Energy-supplier System Planning **(VWE-SP)**

14. Timetable, Vehicle-ordering, Work-force ordering, Energy-supply Planning **(TVW-EP)**

15. Quality Planning **(QP)**

16. Economic Planning (planning of fare-system) **(EP)**

**2. PREPARATION OF CHANGE OF PLACE AND TRAVEL**

Orientation about the possibilities | Reservation | Getting in of Fare

21. Timetable, Tariff and Tourist Information **(TTTI)**
- 211. Timetable Extract Preparing **(TEP)**
- 212. Itinerary Preparing **(IP)**
- 213. Tourist Information Supply **(TIS1)**
- 214. Complex Information Supply **(CIS)**

22. Reservation **(R)**
- 221. Reservation on Computer Network **(RCN1)**

23. Ticketing **(T)**
- 231. Stand Alone Ticketing **(SAT)**
- 232. Ticketing and Transfer Executing on Computer Network **(TTECN)**
- 233. On Board Ticketing **(OBT)**
- 234. Ticket, Card Handling and Checking **(TCHC)**

**3. CHANGE OF PLACE, TRAVEL**

Lead of the passenger to the vehicle | Passenger informatics on board of the vehicle | Lead of the passenger off the vehicle

31. Lead TO Vehicle Information **(LTOVI)**
- 311. Personal Navigation (from the origin to the entrance of the station) **(PN1)**
- 312. Travel Information (service departures) **(TI1)**
- 313. Information for Orientation at the Stations (from entrance to the vehicle) **(IOS1)**
- 314. Passenger Comfort Information Supply **(PCIS1)**

32. On Board Information **(OBI)**
- 321. Information for Inner Space and Seats **(IISS)**
- 322. Information Supply regarding Travelling **(IST)**
- 323. Information for Operation of Inner Devices and Sockets **(IOIDS)**
- 324. Passenger Comfort Information Supply **(PCIS2)**
- 325. Other Telematics services **(OT)**
- 326. MArketing-Information Supply **(MAIS)**
- 327. Tourist Information Supply **(TIS2)**

33. Lead OFF Vehicle Information **(LOFFVI)**
- 331. Travel Information (service arrivals) **(TI2)**
- 332. Information for Orientation at the Stations (from the vehicle to exit) **(IOS2)**
- 333. Travel Information (service departures for further travelling) **(TI3)**
- 334. Passenger Comfort Information Supply **(PCIS3)**
- 335. Personal Navigation (from the exit of the station to the destination) **(PN2)**

**4. INFORMATION AFTER TRAVELLING**

Data retrieving

41. Lagguage Retrieving **(LR)**

42. Passenger retrieving by Reservation system on Computer Network **(RCN2)**

**5. PASSENGER TRANSPORT REVIEW**

Accounting | Evaluation | Preparing of archives

51. Performance Accounting **(PA)**

52. Resources Accounting **(RA)**

53. Financial Accounting **(FA)**

54. Statistics Preparing **(SP)**

55. Quality Control and Analysis **(QCA)**

56. Archives Preparing **(AP)**

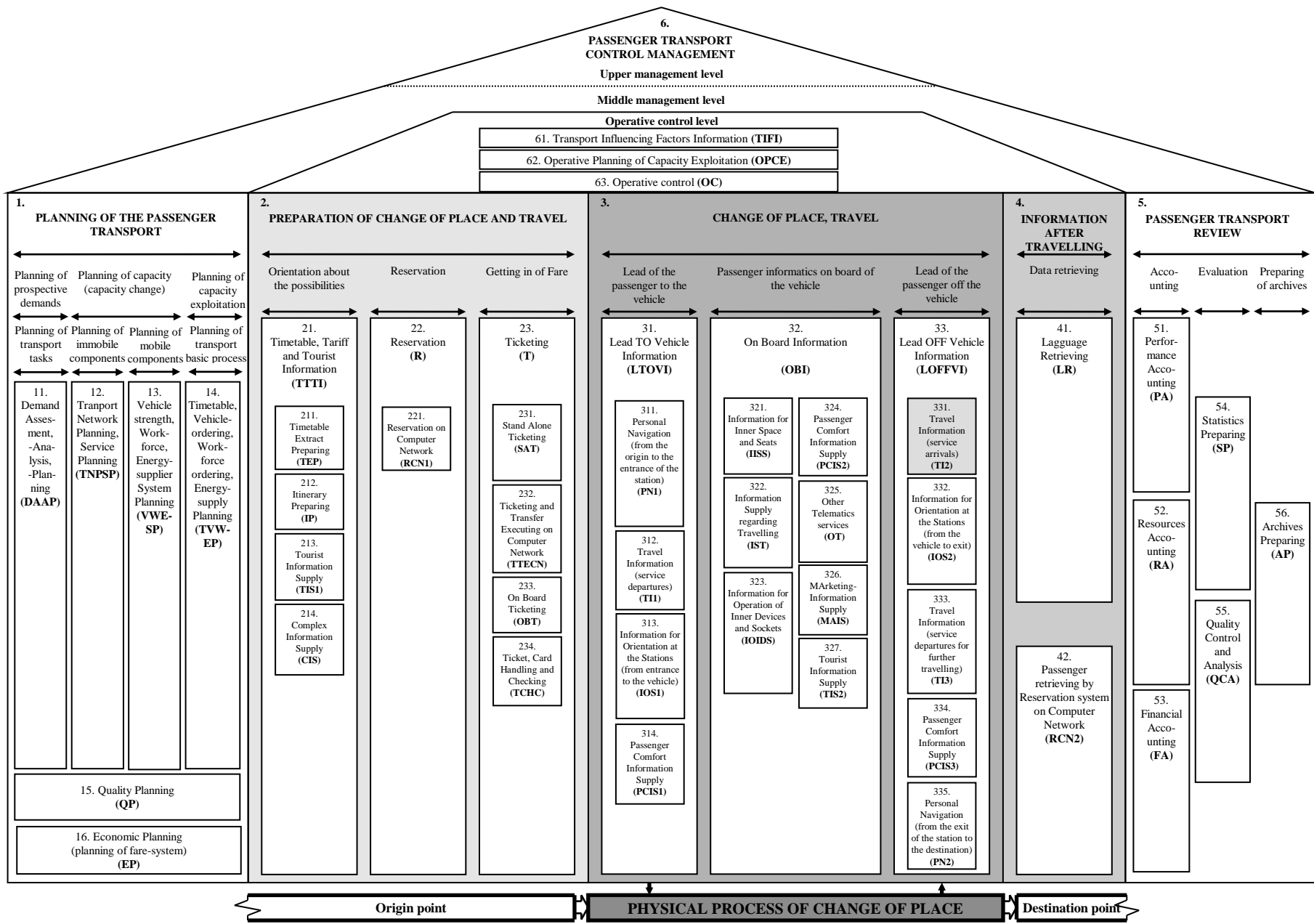Origin point | **PHYSICAL PROCESS OF CHANGE OF PLACE** | Destination point

Fig. 1. The structure of the passenger transport process – processlogical order of subsystems of the integrated system

the immobile (transport network) and mobile (vehicles, workforce, energy-supplier system) components. Their planned, organised, controlled co-operation means the dynamic structure of the transport basic process. For the sake of the control, it is needed to establish control organisation. The elements of it are the machines, the people and the *information system*. They mean the static structure of the transport control process. The dynamic structure of the transport control process is the co-operation of these elements. The dynamic structure is a control loop with information gathering, information transfer, information storage, information processing and information dissemination. The passenger information service is part of this structure.

All of the five structure can be depicted by the information and the information system itself is part of the transport control process static structure. Consequently, the structure of the information system of the integrated passenger informatics system follows this kind of decomposition of the transport system.

## DEPICTION OF THE WHOLE PASSENGER TRANSPORT SYSTEM BY INFORMATION

The information systems of planning, account and control systems are the information sources of the passenger informatics systems. These systems depict the whole transport system, all of the structures. The depiction can be seen on Figure 2. [2]. On the bottom of the figure are - with grey background - the functions, tasks of the transport system - the *function structure*. Above it the immobile and mobile components can be seen (with grey background) - the *transport basic process static structure*. These components work together in the basic process. It - the *transport basic process dynamic structure* can be seen between the mobile and immobile components (with dark grey background). The control systems are built on the basic system. *The static and dynamic structure of the transport control process* can be seen above the basic system. The dynamic structure is marked - partly - with the arrows between the subsystems. The figure shows with broken arrows the depiction of the certain structures. The operation of the passenger transport system is influenced by many additional external and internal components. External component is for example the weather. Internal component is for example the fare-system. The system can not operate without the data of previous plans and facts. This, in archivation stored data is essential for control.

## STRUCTURE OF THE INTEGRATED DATABASE

In the integrated database all the data flows logically assemble together, and the data coming from many and different sources is handled in appropriate structure. At executing of the passenger information supplying functions, from this data base is needed and possible to obtain data. The stored data can be grouped in four steps, by four aspects.
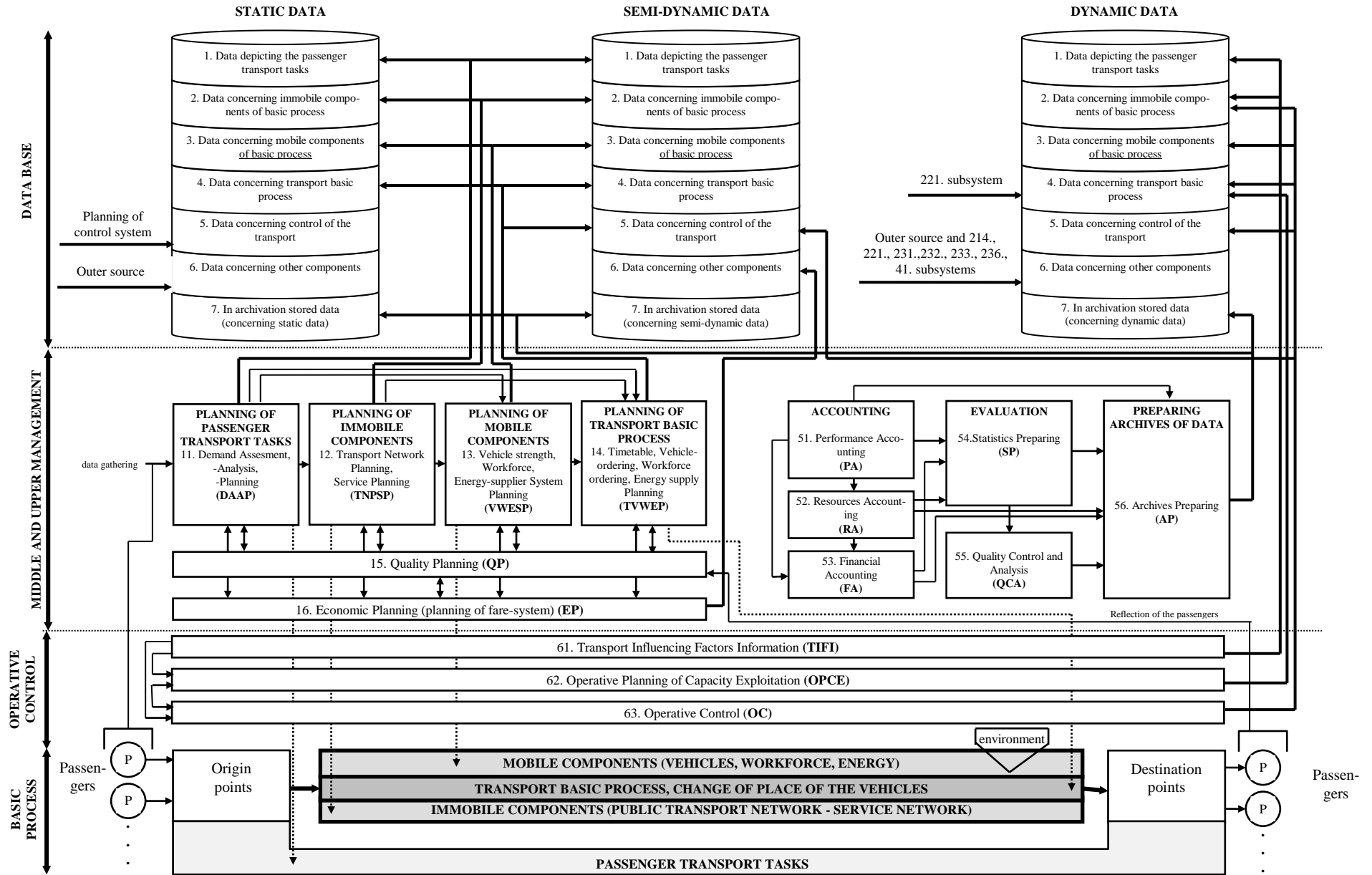
**STATIC DATA**  **SEMI-DYNAMIC DATA**  **DYNAMIC DATA**

**DATA BASE**

Static Data cylinder:
1. Data depicting the passenger transport tasks
2. Data concerning immobile components of basic process
3. Data concerning mobile components of basic process
4. Data concerning transport basic process
5. Data concerning control of the transport
6. Data concerning other components
7. In archivation stored data (concerning static data)

Semi-Dynamic Data cylinder:
1. Data depicting the passenger transport tasks
2. Data concerning immobile components of basic process
3. Data concerning mobile components of basic process
4. Data concerning transport basic process
5. Data concerning control of the transport
6. Data concerning other components
7. In archivation stored data (concerning semi-dynamic data)

Dynamic Data cylinder:
1. Data depicting the passenger transport tasks
2. Data concerning immobile components of basic process
3. Data concerning mobile components of basic process
4. Data concerning transport basic process
5. Data concerning control of the transport
6. Data concerning other components
7. In archivation stored data (concerning dynamic data)

Planning of control system

Outer source

221. subsystem

Outer source and 214., 221., 231.,232., 233., 236., 41. subsystems

**MIDDLE AND UPPER MANAGEMENT**

data gathering

**PLANNING OF PASSENGER TRANSPORT TASKS**
11. Demand Assesment, -Analysis, -Planning (**DAAP**)

**PLANNING OF IMMOBILE COMPONENTS**
12. Transport Network Planning, Service Planning (**TNPSP**)

**PLANNING OF MOBILE COMPONENTS**
13. Vehicle strength, Workforce, Energy-supplier System Planning (**VWESP**)

**PLANNING OF TRANSPORT BASIC PROCESS**
14. Timetable, Vehicle-ordering, Workforce ordering, Energy supply Planning (**TVWEP**)

**ACCOUNTING**
51. Performance Accounting (**PA**)
52. Resources Accounting (**RA**)
53. Financial Accounting (**FA**)

**EVALUATION**
54. Statistics Preparing (**SP**)
55. Quality Control and Analysis (**QCA**)

**PREPARING ARCHIVES OF DATA**
56. Archives Preparing (**AP**)

15. Quality Planning (**QP**)

16. Economic Planning (planning of fare-system) (**EP**)

Reflection of the passengers

**OPERATIVE CONTROL**

61. Transport Influencing Factors Information (**TIFI**)

62. Operative Planning of Capacity Exploitation (**OPCE**)

63. Operative Control (**OC**)

**BASIC PROCESS**

Passengers

P

P

Origin points

environment

MOBILE COMPONENTS (VEHICLES, WORKFORCE, ENERGY)

TRANSPORT BASIC PROCESS, CHANGE OF PLACE OF THE VEHICLES

IMMOBILE COMPONENTS (PUBLIC TRANSPORT NETWORK - SERVICE NETWORK)

PASSENGER TRANSPORT TASKS

Destination points

P

P

Passengers

Fig. 2. Depiction of the passenger transport system by information

**I.** In accordance with the depiction the stored data in the database of the integrated intelligent passenger informatics system can be grouped among the following groups:
1.  data depicting the passenger transport tasks,
2.  data concerning immobile components of basic process,
3.  data concerning mobile components of basic process,
4.  data concerning transport basic process,
5.  data concerning control of the transport,
6.  data concerning other components,
7.  in archivation stored data.

On the figure the fat arrows show the sources of the certain data groups.

**II**. The data can be grouped further by its time permanent feature. In this way there are the groups of the static, semi-dynamic and dynamic data. [1],[2].

**III.** Within the certain data groups additional data subgroups can be formed by the classification of the components or breaking down of the processes. The number of the levels of subgroups depends on the depth of the decomposition.

**IV.** The last step of the classification is the determination of the certain data elements.

When we analyse the data connecting it to the systems and to the systems' functions, there are additional aspects for classification. These aspects are *direction and connection features*. If we consider the direction feature, a data element can be in the case of a system input or output data. If we consider the connection feature, it is important, that which system is the origin and destination system of the data element. In case of one data element the direction and connection features can vary in the integrated system.

CONCLUSION

The essence of the integrated system is the stated information and data system. The model of the information system can be used as starting point at the further modelling and planning processes.

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