Project for the Terminus at Redycka Street

Wojciech Kozłowski
Opole University of Technology, Poland

Mirosław Szewczyk, Jakub Szlązak, Wojciech Czechowicz,
Karol Markowski, Damian Krawczyk, Piotr Wdowczyk
The International University of Logistics and Transport in Wroclaw, Poland

The aim of the paper is to present a modernization project for the terminus at Redycka street in Wroclaw. The social amenity for the drivers and for the terminus staff has been designed. Additional equipment has been suggested, whose aim is to improve the terminus proper functioning. Also staff and passengers comfort has been taken into consideration. Proper pavement for the terminus has been designed as well.

Keywords: modernization, terminus, rebuilding, shelter.

1. INTRODUCTION

Citizens, in search of a peaceful life, commute from city centres, where they work, to outskirts, where they can have a rest. The municipal transport company, MPK, in order to connect different parts of the city in the best possible way, generates many bus and tramway lines. Complex infrastructure is needed for every of such investments, whose elements are, among others, bus stops, integrated stops, terminuses [12,13,14].

Work conditions are considered nowadays as an important factor. Municipal Transport Company's drivers in Wrocław work on average 8 hours 10 minutes. Working, they spend many hours driving through crowded Wrocław. Their work breaks are no longer than 15 minutes. They spend them on terminuses, which are not always properly equipped. The drivers work all year long- during hot summer and snowy winter, sometimes they drive at night. However, they are expected to be fully concentrated in order to ensure safety, security and proper comfort to passengers. [5].

Very often drivers are not satisfied with work conditions - they complain about lack of facilities, where they could eat something, drink coffee or tea, use a bathroom or even have a shower. A big problem in Wrocław for the bus and tramway drivers is either lack of such a facility or the fact that such facilities are not sufficiently equipped. They are equipped only with Toi-Toi portable toilets. It is very difficult to use them in winter time, and using them in the summer is not the nicest experience. Very often the drivers have to eat meals sitting in a vehicle. Noise is another factor which influences safety and security on the road, as the drivers can feel more tired and less relaxed.

2. PRESENT STATE

The terminus is situated in Wroclaw. The arrival to the terminus is from Redycka street, while the departure from Lekcyjna street. Two daily buses, 116 and 119, as well as one night bus, 246, use the terminus, which is adapted both to typical and to articulated buses.

The pavement consists of 4-cm mineral aggregate layer, bound together with asphalt, 6-cm layer of concrete asphalt, 10-cm layer of basic substructure of concrete asphalt and 22-cm basic substructure of mixture not bound with aggregate. Additionally, a lower layer of the pavement consists of 15-cm subsidiary substructure. It consists of mixture bound with hydraulic binding materials or ground stabilized with hydraulic binding material. The pavement at the terminus is 7-meters wide and the parking space takes 3.5 meters. Sidewalks, whose width is 1.40 meters, are made of concrete blocks [2, 3, 4, 10, 11, 15].

There is one shelter for passengers, waiting for a bus. It is a sufficient solution at the terminus, as

passenger traffic is not big there. Buses usually leave empty, or with only a few passengers in rush hours. The terminus should be equipped with another shelter, if additional bus lines were introduced. At the terminus there is also a waste bin, bus timetable, and nearby, a Toi Toi portable toilet for the drivers.

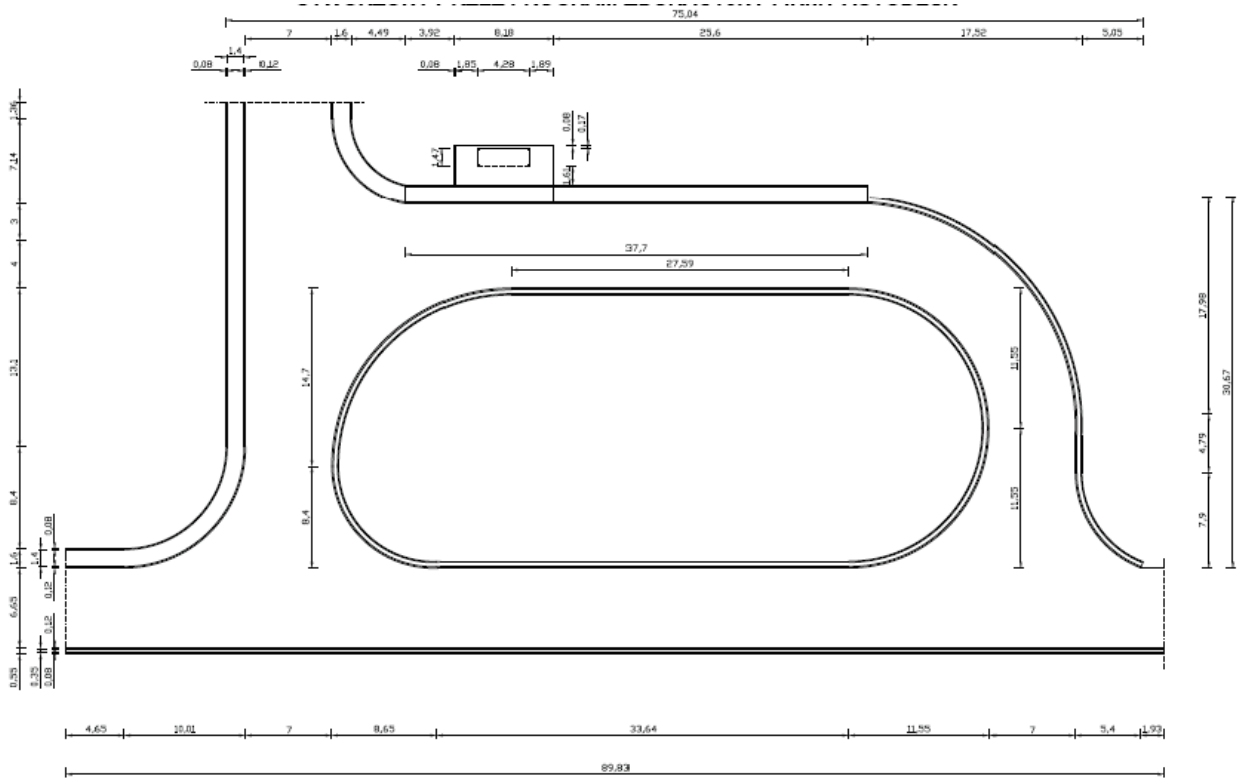

Fig. 1. Terminus dimensions (own elaboration).

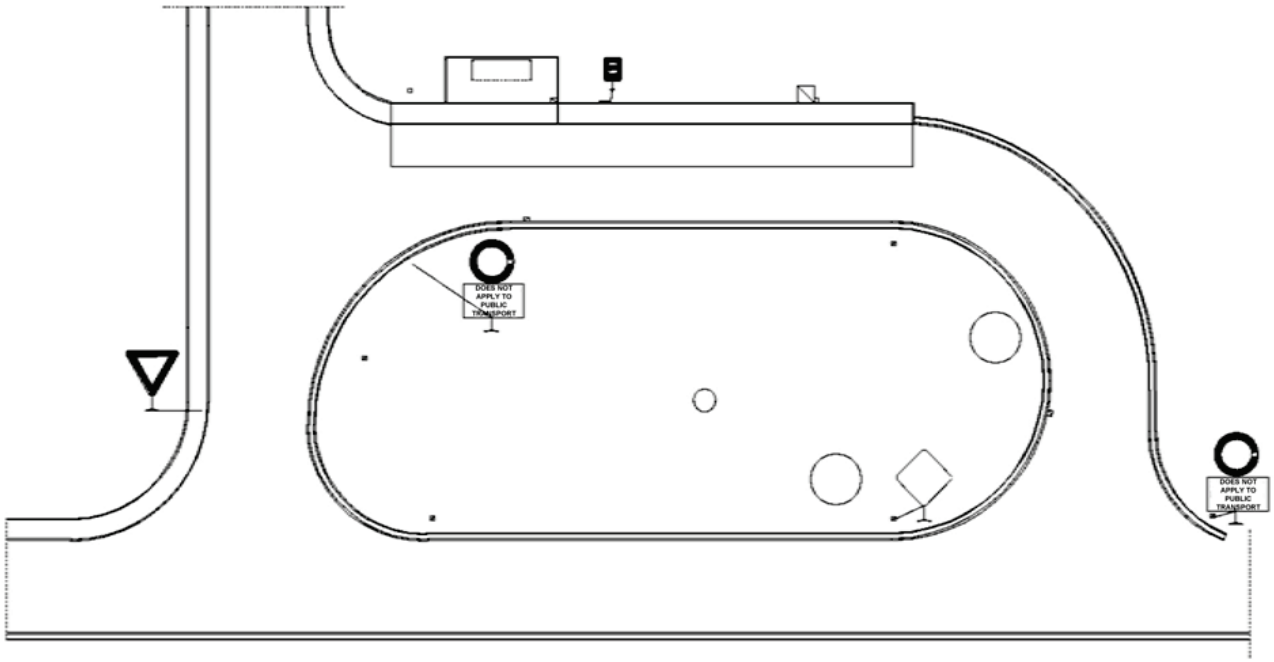

Fig. 2. Terminus site plan (own elaboration).

3. SUGGESTION OF REBUILDING

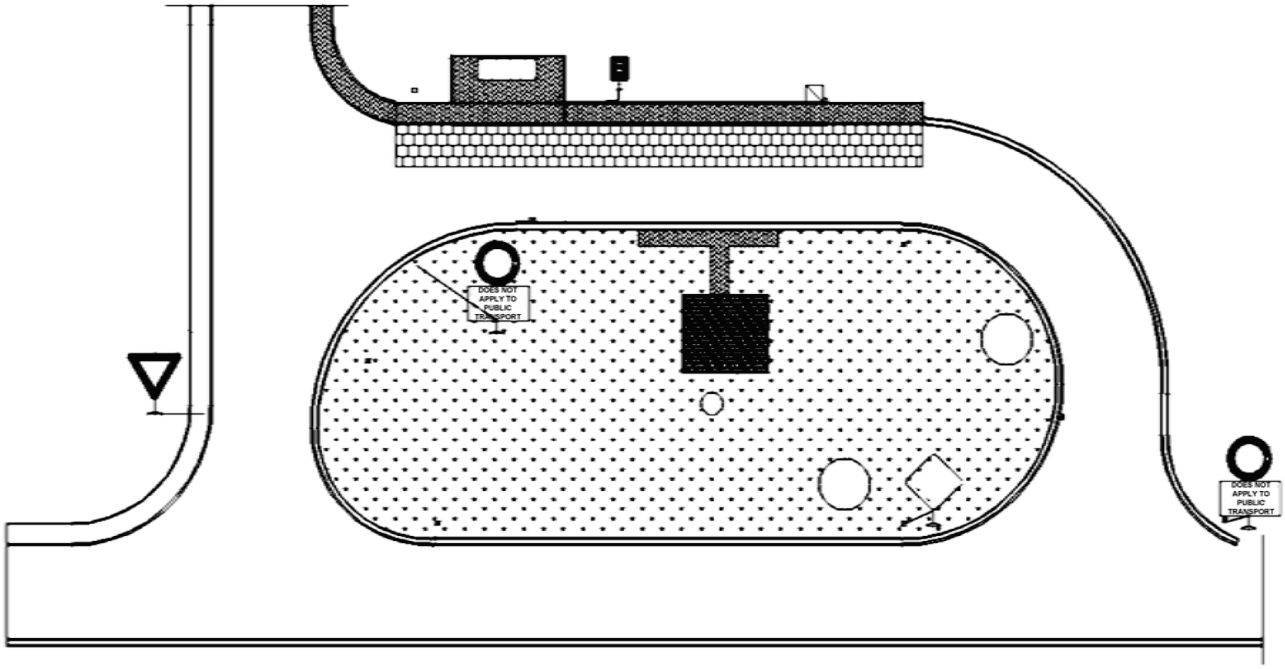

Fig. 3. Amenity's location (own elaboration).

The inspection of the terminus at Redycka street showed that the pavement was in good condition with no potholes or cracks.

The kerbs are often broken or with potholes, due to the constant over-running of buses. Therefore the kerbs should be replaced by new ones. Parking space, made of set stone, fulfils its purpose. In the summer, when temperatures are very high, there is no danger that buses wheels will sink in the ground [2, 3, 6]. The place where passengers wait should be refurbished. The dust bin and the carport should be repainted, and the scratched windows at the carport should be replaced. The main element of refurbishment was to design a facility for bus drivers. The project was made, which consists of a fully equipped kitchen, a room where meals can be eaten, a bathroom with a toilet, a shower and a sink. Also a room with bed was designed, to give the drivers possibility to have a rest during a night shift. The main assumption was to design a facility which would be comfortable for the drivers but which would be relatively small, in order to use the project for future modernizations at other terminuses, both tramway and bus ones.

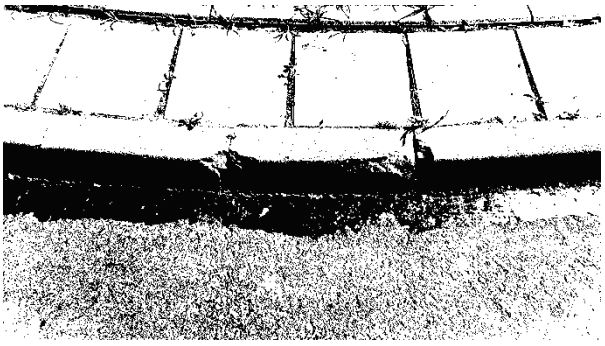

Fig. 4. Damaged kerbs, seen from the inner part of the terminus (own elaboration).

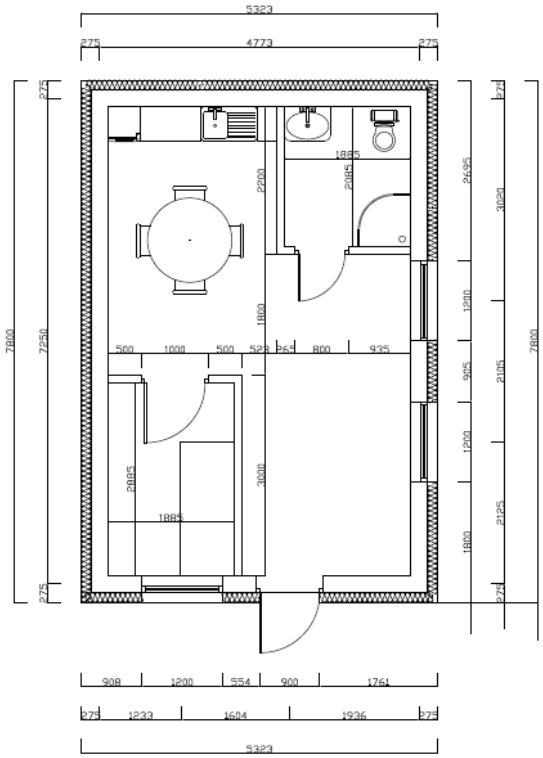

Fig. 5. Amenity's cross section (own elaboration).

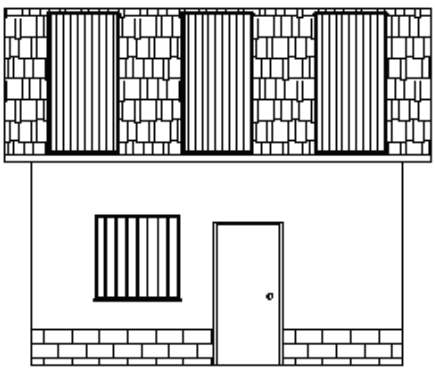

Fig. 6. Front elevation (own elaboration).

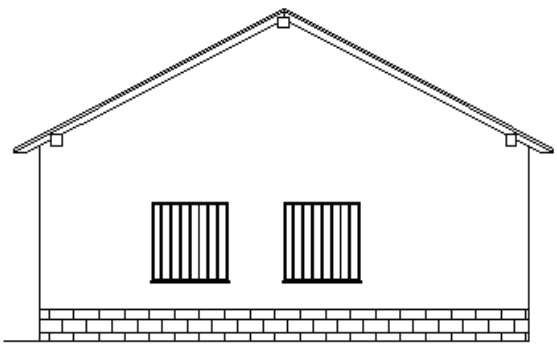

Fig. 7. Side elevation seen from the west (own elaboration).

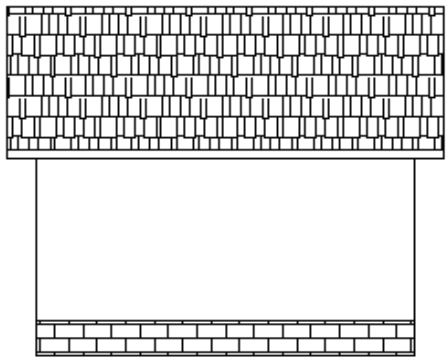

Fig. 8. Backward elevation (own elaboration).

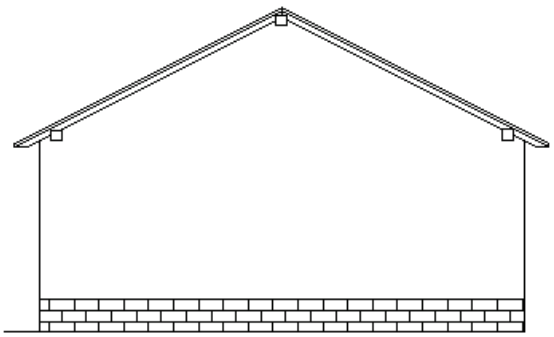

Fig. 9. Side elevation seen from the east (own elaboration).

4. TECHNICAL DESCRIPTION

4.1. GENERAL DATA

4.1.1. Destination of the amenity building and its practical use

Amenity building, of one floor, is designed for public transport drivers. It is situated at the terminus, identification number 4/27 at Redycka and Lekcyjna streets, identification unit of the city of Wroclaw.

4.1.2. Information of the amenity building surface are and important figures

The dimensions of the building:
- The length of the building 7.80 meters
- The width of the building 5,323 meters
- Total height of the building
- (from pos. area to the ridge of the roof) 5,117 meters

Table 1. The surface area of each room (own elaboration).

Nr	Room	Surface area [m2]
0/1	Corridor	7.28
0/2	Kitchen	13.67
0/3	Bathroom	3.93
0/4	Social room	5.44

4.2. ARCHITECTURAL AND CONSTRUCTION SOLUTIONS

4.2.1. Form and function of the building

Amenity building, of compact block, covered with a gable roof with a slope of 26 degrees.

4.3. DATA REGARDING THE CONSTRUCTION OF THE BUILDING

4.3.1. Design and layout

An amenity building without a basement, situated on a ground floor. The dimensions of the horizontal projection of the outline are 7.80 × 5.323 meters, height from the ground to the roof ridge 5.117 meters.

Load-bearing walls of cellular concrete blocks.

4.3.2. Building solutions regarding construction and materials

4.3.2.1. Earthworks

In case of conducting earthworks in cohesive soils, these works should be conducted in such a way, to avoid accumulation of water in trenches. It would soften the soil and significantly reduce its strength parameters. Foundation cannot be leaved unsecured for winter, due to soil freezing. Both foundation and foundation backfill should be hand-deepen and hand-made. Additionally, while working with mechanical equipment, the workers are supposed to be trained properly. Earthworks should be also executed by a certified worker, able to work with mechanical equipment.

4.3.2.2. Works at height

The workers, if their worksite is more than 1 meter high from a ground level, should be protected with a railing, at least 1.1 meter high. Work platforms, made of wood planks or logs, should be adapted to the designed load, sealed and secured against change of position. Particular attention should be paid while making roof truss or roofing works.

4.3.2.3. Foundation

In the process of implementing the project, geotechnical assessment of the ground should be done, at the site where building will be situated. Footings of reinforced concrete are 50-cm high and 60-cm wide, according to the project, parallel to the ground surface, with upper groundwater 80-cm below the ground and with no adverse geological phenomena.

4.3.2.4. Foundation walls

Foundation walls, 25-cm thick, should be constructed from cellular concrete blocks. At the top of the wall, reinforced concrete tie beams should be poured, measuring 25 x 25 cm.

4.3.2.5. Walls

Outer walls should be constructed from cellular concrete blocks, 25-cm thick, built on thin mortar system, while inner walls, from cellular concrete block, 11.5-cm thick.

4.3.2.6. Lintels

Lintels over the windows and door openings in load-bearing walls are constructed from reinforced prefabricated beams, type L-19. Minimal width of lintel seat in the wall is 15 cm.

4.3.2.7. Roof

The building is covered with a roof of a wooden structure - purlin forceps, gable roof with a slope angle of 26 degrees. The roof creates a spatial solution that improves aesthetic value of the building.

The structure wood, minimum class- C30, pine or spruce, has to be impregnated twice, with product suitable for wooden elements and making it inflammable, which satisfy all of the requirements for the external fire performance. At the same time it does not reduce the strength of wood and not cause steel corrosion. The preparation should also protect against fungi, mould and insects.

4.3.2.8. Moisture insulation

Horizontal waterproof insulation of the ceilings: The kitchen - tar roofing, the bathroom - liquid bitumen vapour barrier (insulation also on the walls around the tub and sink, also around damp devices)

4.3.2.9. Thermal insulation

Thermal insulation of the walls made of 15-cm thick Styrofoam.

4.3.3. Exterior finish of the building

4.3.3.1. The facades

Exterior plaster according to the selected technology of a chosen company or traditional cement limestone.

4.3.3.2. The windows

Wooden, or PVC windows, according to the selected technology of a chosen company. It is recommended to use the windows that are equipped with window air vents. The system should meet the ventilation requirements, by the appropriate infiltration factor. It is recommended to use window bars.

4.3.3.3. The doors

Standard, according to a catalogue of a chosen company or according to an individual project. In the sanitary facilities it is recommended to use doors with ventilation grate.

4.3.3.4. The roof

Covered with steel sheet tile.

4.3.3.5. The window sills

The exterior window sills- concrete window sills, or made from PVC, or plated sheet, with the colour fitting to the whole building. The interior window sills made from PVC.

4.3.4. Internal finishes of the building

4.3.4.1. Internal plasters

Cement-lime wet plaster is recommended. In the rooms of high degree of humidity, plasterboards resistible to humidity should be used.

4.3.4.2. The floors

In the rooms of high degree of humidity, tiles and moisture insulation are recommended. In other rooms- floor panels.

4.3.4.3. Painting and protective players

The internal walls and ceilings should be painted with acrylic or emulsion paint in the colour that work together with individual interior project. Steel elements should be impregnated with anti-corrosion layer.

4.4. FINAL REMARKS

4.4.1. The construction materials should have the European Union instruction, certificate or declaration of conformity of admission to incorporate into construction works.

4.4.2. In case of any potential doubts, or other circumstances during construction works, the author of the project should be contacted.

4.4.3. All building works, particularly construction works should be conducted under the surveillance of a construction project manager, authorized to manage constructions works.

5. NEW TECHNOLOGIES

5.1. PHOTOVOLTAIC TECHNOLOGY AND LED LAMPS

The goal of implementing new technologies into the project was environment protection. Photovoltaic technology nowadays is widely introduced, even though the costs of implements it are higher, comparing to so called conventional sources. There are two reasons of implementing photovoltaic technology: the ecological and practical ones. In Wroclaw, in many places, we can see equipment or devices equipped with photovoltaic panels. They give opportunity to produce electricity from the Sun. Photovoltaic panels were designed in the project of the amenity. Three photovoltaic panels were placed on the roof. It is sufficient quantity for providing energy for the whole building, without necessity of using external energy sources. The panels will provide energy sufficient for lighting, heating water, heating the building, and finally providing energy for other equipment and devices, for example, signboards. [7, 8, 9].

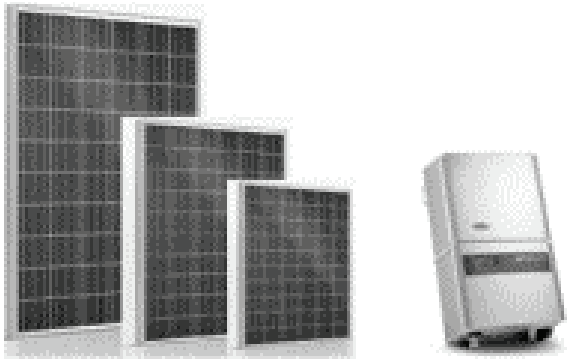

Fig. 10. Street lamp with photovoltaic technology [7].

Photovoltaic technology was designed also for the terminus. LED lamps powered by photovoltaic panels are a very good alternative for standard lightning. They are a very god solution when it comes to diminish costs of use of energy. Lamps can work several hours per day, keeping their autonomy (no exposure to the Sun) for a few days. They can be situated in every single place, with southern exposure. Solar lamps are a very good solution when it comes to streets lightning, and they improve level of safety and security on the roads.

Fig. 11. Photovoltaic panel [9].

5.2. PERPETUAL PAVEMENT

Heavy bus traffic is a cause of pavement damage. The main goal of modernization was to choose proper pavement for the existing conditions. Introducing perpetual pavement is a warrant, that the pavement will last for at least 50 years. Therefore the costs of reconstruction or renovating pavement can be diminished. If perpetual pavement is implemented, only the wearing course has to be replaced periodically.

Due to implementing anti-fatigue layer and rigid layer, resistible to deformation, the wearing course can last much longer.

Using this kind of pavement increases durability of about 150%. Additionally , comparing to traditional pavement, perpetual pavement is able to transfer about 142 millions of equivalent axles, of load of 100kN.

5.3. WI-FI AND GPS FOR FREE

The 21st century is the age of the Internet. The Internet free of charge can be caught in almost every place in Wroclaw. Possibility of using the Internet at the terminus will make it easier and nicer for passengers waiting for a bus. Additionally, due to the access to the Internet it will be possible to use applications, such as buslive.pl, whose aim is to track and trace public transport vehicles. Therefore passengers will be able to asses assumable time of arrival or departure of a bus and its delay.

5.4. MODERN BUS SHELTERS

While refurbishing the terminus and looking for new technologies we cannot forget about the main elements of the terminus, which is a shelter. Our suggestion is a mixture of multimedia shelter from Cracow with a shelter from Dubai. It is a closed shelter with air-conditioning, with possibility of heating it in winter. Additionally, it is equipped with two touch screens, with timetable, tickets prices and important phones numbers. The main advantage of the screens is a possibility of

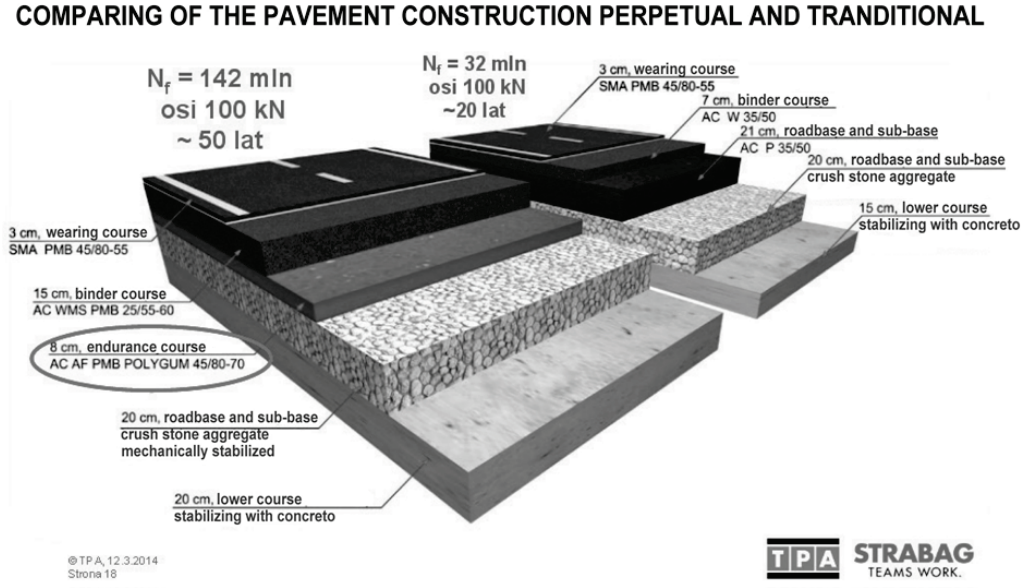

Fig. 12. Comparing traditional and perpetual pavement [16].

enlarging the font, according to the passenger needs. Variable message boards have been suggested for the project. This solution would enable passengers to verify which bus and at what time leaves the terminus. It is a very convenient solution for elderly people, who have problems with reading small letters on standard timetables. Big, shiny letters can make it easier to read the timetable also at night.

6. CONCLUSIONS

The project can significantly improve the standard of using the terminus, both for the passengers, and the drivers. Implementing the utility project on one of two terminuses of each line can improve the drivers' work standard. A refreshed and relaxed driver will concentrate more while driving, which can significantly influence the safety and security of his work. The amenity building is easy to construct and relatively small, therefore it can be easily used in small terminuses. Due to use of modern technologies it will be also environmental friendly and independent of power grid.

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Wojciech Kozłowski
Opole University of Technology, Poland
mr3002@wp.pl

Mirosław Szewczyk
The International University of Logistics and Transport in Wroclaw, Poland
miroslaw.w.szewczyk@gmail.com