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HUSRB/23S/31/032

# Situation study about the cross-border points between Serbia and Hungary

## Final report

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# 1. INTRODUCTION

The border between the Republic of Serbia and the Republic of Hungary stretches along the north of Serbia and the southeast of Hungary, with an approximate length of 174.7 km. Along this border, there are nine road border crossings, two railway border crossings (1. Subotica – Kelebia; 2. Horgoš – Röszke), and two river border crossings (1. Bezdan – Mohács on the Danube River and Kanjiža – Szeged on the Tisa River).

This border holds significant geopolitical and economic importance, as it connects two countries belonging to different cultural and political spheres — Hungary, a member of the European Union and part of the Schengen Area, and Serbia, which is not an EU member but is an important partner in regional and European initiatives.

The border stretches from the western to the eastern part of the region, from the tri-border point between Hungary, Serbia, and Croatia to the tri-border point between Serbia and Romania. One of the most important natural features marking this border is the Tisa River, which partially separates the two countries. Historically, this border was established after World War I, in 1918

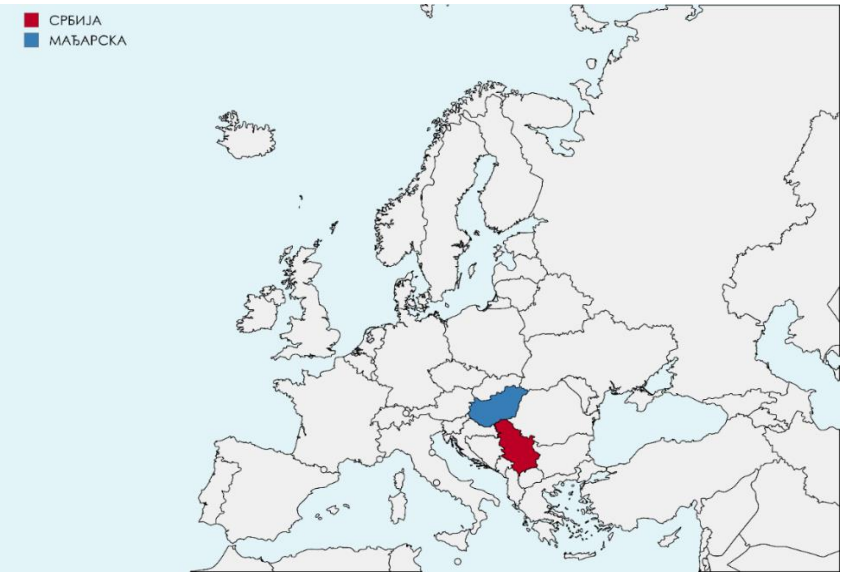


Figure 1-1 Geographical Position of the Republic of Serbia and the Republic of Hungary in Relation to Other European Countries

Border crossings between Serbia and Hungary play a key role in enabling the smooth movement of people and goods between these two strategically important regions of Central Europe. Crossings such as Horgoš, Kelebia, and others are not merely administrative checkpoints, but vital hubs that facilitate economic exchange and the development of tourism. Their efficiency directly affects the dynamics of trade flows and infrastructure projects, playing an important role in the economic development of both countries.

## Subject of the study

The subject of this analysis, or study, is the traffic flows at the road border crossings between Serbia and Hungary, which include the following points:

1. Bački Breg (SRB) – Hercegszántó (HUN)
2. Rastina (SRB) – Bácsszentgyörgy (HUN)
3. Bajmok (SRB) – Bácsalmás (HUN)
4. Kelebija (SRB) – Tompa (HUN)
5. Horgoš (SRB) – Röszke (HUN)
6. Horgoš 2 (SRB) – Röszke (HUN)
7. Bački Vinogradi (SRB) – Ásotthalom (HUN)
8. Đala (SRB) – Tiszasziget (HUN)
9. Rabe (SRB) – Kübekháza (HUN)

These crossings are not merely physical connections between the two countries, but represent important infrastructure points that enable the smooth flow of goods, passengers, and tourists. They play a significant role in the economic and regional integration of both countries.

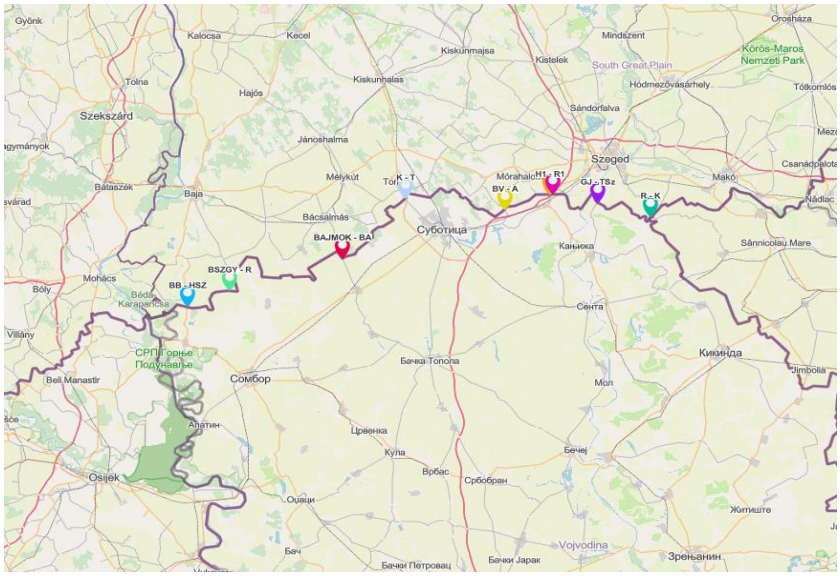


Figure 1-2 Position of the cross-border points between Republic of Serbia and the Republic of Hungary

## Objectives of the study

The general objective of the study is to determine, based on the conducted research, the key parameters and characteristics of traffic flows at the road border crossings between Serbia and Hungary during the observed reference periods, specifically:

- demand for the flow of vehicles and passengers,
- the structure of traffic flow,
- temporal distribution of vehicle and passenger flows,
- occupancy rate of passenger vehicles,
- waiting times for vehicles and passengers, as well as the time distribution of waiting times.

According to before mentioned, the study presents the research results and the stratification of collected data from various relevant sources. The first part of the document provides a brief methodological framework, followed by a narrative description and graphical presentation of the results for passenger and vehicle flows at the observed border crossings, vehicle occupancy, as well as the presentation of waiting times. In the final part, the consolidated analysis results are interpreted, and the border crossings are evaluated according to the classes of waiting-time acceptability.

# 2. METHODOLOGY OF STUDY DEVELOPMENT AND DATA PRESENTATION

In accordance with the defined methodology, the present study was implemented through three coordinated and interdependent phases with sub-activities. The following provides an overview of the activities and sub-activities carried out.

## Preliminary research

Within this activity, data were collected from the relevant institutions, namely:

- Statistical Office of the Republic of Serbia: publicly available data from statistical reports.
- Public Enterprise "Roads of Serbia": data from automatic traffic counters on state roads to which the border crossings belong, data provided upon a special request by the study developer.
- Ministry of Interior – Border Police Directorate of the Republic of Serbia: data on passenger flows at monthly and daily levels for the reference periods.

Based on data available from the annual and quarterly reports of the Statistical Office of the Republic of Serbia, datasets on traffic load at border crossings were formed. In addition, based on the delivered data on vehicle flows at sections of state roads for the period 01.07.2024 – 31.08.2025 at the level of hourly and daily flow distributions, as well as the data on passenger and vehicle flows provided by the Ministry of Interior – Border Police Directorate of the Republic of Serbia, the fundamental regularities of the temporal distribution of traffic volumes at the observed border crossings were determined.

## Planning and implementation of field research

In the first step, all border crossings were visited, as well as initial meetings held with representatives of the Ministry of Interior (MoI) in order to collect information on the operation of each individual border crossing. Based on the preliminary dataset formed, as well as on information collected from MoI representatives and partners, the reference periods were defined. The reference periods covered key parts of the year, taking into account days with regular i.e. usual traffic conditions—off-season, and periods during public holidays and tourist migrations—season. Accordingly, the following reference periods were defined for analysis and research:

- 27.12.2024 – 06.01.2025
- 03.02.2025 – 09.02.2025
- 31.03.2025 – 06.04.2025
- 16.04.2025 – 22.04.2025
- 09.06.2025 – 15.06.2025
- 09.07.2025 – 15.07.2025
- 23.08.2025 – 24.08.2025

Data for the periods 27.12.2024 – 06.01.2025 and 03.02.2025 – 09.02.2025 were considered historical, based on officially collected data, while in the remaining periods, alongside official data provided by the competent institutions, field measurements were conducted. Field measurements were carried out in two ways:

- measurement of waiting times by in-traffic observation, whereby a team of researchers, during the observed periods and times of day, measured waiting times as participants in the traffic stream, and
- systematic traffic counting, conducted on working days and weekends at each border crossing, during which the lawful patterns of traffic-flow behaviour were recorded in terms of the temporal waiting time of individual vehicles in the stream, irregularities in hourly time intervals, and the occupancy of passenger vehicles.

Figure 2-1 Systematic traffic counting – field research

## Data processing and presentation of results

Using the data provided by the institutions, as well as the data collected in the field, a unified dataset was formed. Through further processing of the observed dataset, the parameters were determined in accordance with the requirements of the study.

The flow of vehicles and passengers at the border crossings was processed at the monthly level for the period June 2024 – July 2025, as well as at the daily level for the observed reference periods. The analysis is based on data provided by the Ministry of Interior – Border Police Directorate of the Republic of Serbia.

Vehicle flow on the state road network was analyzed by days for the period 1.7.2024 – 1.9.2025, presented in veh/day. The analysis is based on data provided by the Public Enterprise Roads of Serbia.

Vehicle occupancy refers to the number of passengers in the vehicle, including the driver. Only passenger cars and passenger vans were considered as vehicles. The data was established through direct on-site observation at all border crossings. Methodologically, the data were analyzed for working days (WD) and weekend days (WKD). All vehicles were classified into five categories according to the number of persons in the vehicle, and a visual presentation was provided by means of a chart in which the x-axis represents the passenger-count categories (1, 2, 3, 4, ≥5), and the y-axis the percentage of vehicles with a given number of passengers.

Waiting time at the border crossing is defined as the time period that elapses from the moment the vehicle arrives at the border crossing and stops in the waiting queue on the side of the Republic of Serbia (arrival into the system), to the moment of completion of passport and customs control on the side of the Republic of Hungary (departure from the system). Methodologically, the starting point consists of hourly time series of waiting times interpolated to the level of an "average day" for WD and WKD profiles in both observed periods. For each border crossing and each profile, key descriptive statistical values were calculated: the average hourly value (μ), the standard deviation (σ), the minimum and maximum recorded

average hourly waiting time, as well as indicative daily peak periods during the day in the ranges 00–06, 06–12, 12–18 and 18–24 hours, which serve to identify dominant loads during the day. Peak hourly loads are defined by the μ+σ threshold, which makes it possible to identify the hours in which statistically pronounced deviations appear relative to the baseline load level. In addition to the individual profiles, the report analyses the differences between season and off-season, as well as between WD and WKD.

To interpreting the results, classes were defined based on the waiting-time criterion, i.e., the sum of the mean value (μ) and the standard deviation from the mean (σ): ≤30 minutes (acceptable), 30–60 minutes (marginally acceptable), 60–120 minutes (unacceptable) and >120 minutes (extremely unacceptable).

### Methodological note

This analysis is designed to describe typical conditions through hourly averages across two characteristic seasons and two-day types. The external factors listed are not fully modelled (e.g., there is no explicit incident module), therefore all conclusions regarding expected behavior refer to the reference (standard) operating regimes that were established during the defined reference periods.

## 2.1. Limitations and factors of result variability

Although the presented indicators are based on the systematic processing of hourly averages, in real operating conditions at border crossings there is a certain likelihood of individual values deviating from the displayed ranges. These deviations arise from the combined effect of operational, infrastructural, and external factors that could not be fully captured by the present analysis. The key sources of variability, their mechanism of action, the expected magnitude of effect (qualitatively), as well as the implications for interpreting the results and managing capacity, are considered below.

Disturbances in the traffic flow (uneven vehicle arrivals) may be caused by temporarily increased demand due to road works, temporary lane closures, traffic accidents, or diversion from neighbouring border crossings, as well as the impact of extreme weather conditions. Such phenomena in the traffic stream generate uneven, platooned arrivals, which violate the assumption of an approximately even arrival distribution of vehicles in the flow. The consequence is a short-term increase in waiting time above the average values (μ), often up to the level of μ+σ or higher. This effect most frequently appears during periods of high load in seasons or holidays.

Variations in the number of active passport-control counters, staff shifts/experience and work dynamics, the current capacity and deployment of Border Police officers affect the effective operation of the border crossing. Even at the same vehicle flow, the reduction of a single active position in the peak hour may produce a disproportionate increase in waiting time due to the non-linear relationship between load and queue length. This factor explains observed local deviations without an accompanying increase in vehicle flow and is particularly pronounced at border crossings with multiple service channels.

Likewise, the capacities and deployment of Customs staff as the second layer of control when crossing the border can affect the waiting time of all vehicles in the stream. More complex inspections, secondary controls and sanitary/phyto inspections, as well as the number of vehicles passing through such types of control, cause longer dwell times with greater dispersion. The effect may be more pronounced during weekends and the season, when the share of "atypical" crossings increases, and it is especially evident at border crossings with minimal staffing capacity of this service.

Changes in operational protocols (e.g., introduction of more detailed verification, enhanced security checks, targeted inspections) influence the distribution of service time per vehicle. In

addition, in cases of irregularities in the functioning of information and communication systems (passport control, communications), whether partial or complete, interruptions in border-crossing operations occur. Although rare, these events have an exceptionally large impact on waiting time and may temporarily disrupt the stability of hourly averages, particularly under high-load regimes. The effect of these disturbances manifests as an exponential increase in waiting times, most often with a delayed return to normal operations, given that the queues formed dissipate more slowly than they form.

The occurrence of some of the above situations limits the reliability of the presented results. The displayed μ (mean) and σ (standard deviation) apply as a representation of statistically "normal" conditions at the level of an average working day/weekend within the off-season and seasonal periods. In the event of the above disturbances, an increase in σ and a rise in maximum values can be expected. Uneven arrivals and a reduction in service capacity at a crossing are first reflected in the peak periods; therefore, the identified peak hours should be viewed as typical, i.e., real peak load may be even more pronounced in terms of duration and intensity. In the season, deviations are more pronounced because newly emerged disturbances are superimposed on an already elevated baseline load.

# 3. CHARACTERISTICS OF BORDER CROSSINGS

This section provides a description of the analysed border crossings, which includes the spatial position of each crossing in relation to nearby settlements and the road network, the opening hours of the crossing, passenger category, the number of traffic lanes at exit from the country (under regular operating conditions), the type of traffic, as well as the availability of video surveillance accessible to users (passengers) of the border crossing.

## Bački Breg – Hercegszántó

The crossing is located in the western part of Bačka, along the Danube, with a natural gravity towards Sombor and Bezdan on the Serbian side and towards Hercegszántó in Hungary. In terms of traffic connections, it is linked to State Road IB-15, which from Bački Breg leads via Sombor and further through Bačka towards Banat (IB-15: Bački Breg – Kikinda), providing a regional connection to the wider area of Vojvodina.

Table 3-1 Basic characteristics of the border crossing Bački Breg – Hercegszántó

| **Parameter** | **Description** |
|---|---|
| Abbreviation | BB - HSZ |
| Operating hours | 00:00 – 24:00 |
| Number of exit lanes for passenger traffic | 2 |
| Permitted passenger categories | Citizens of all countries |
| Type of traffic | Passenger and road freight traffic (3.5 t) |
| Traffic-status cameras available | No |

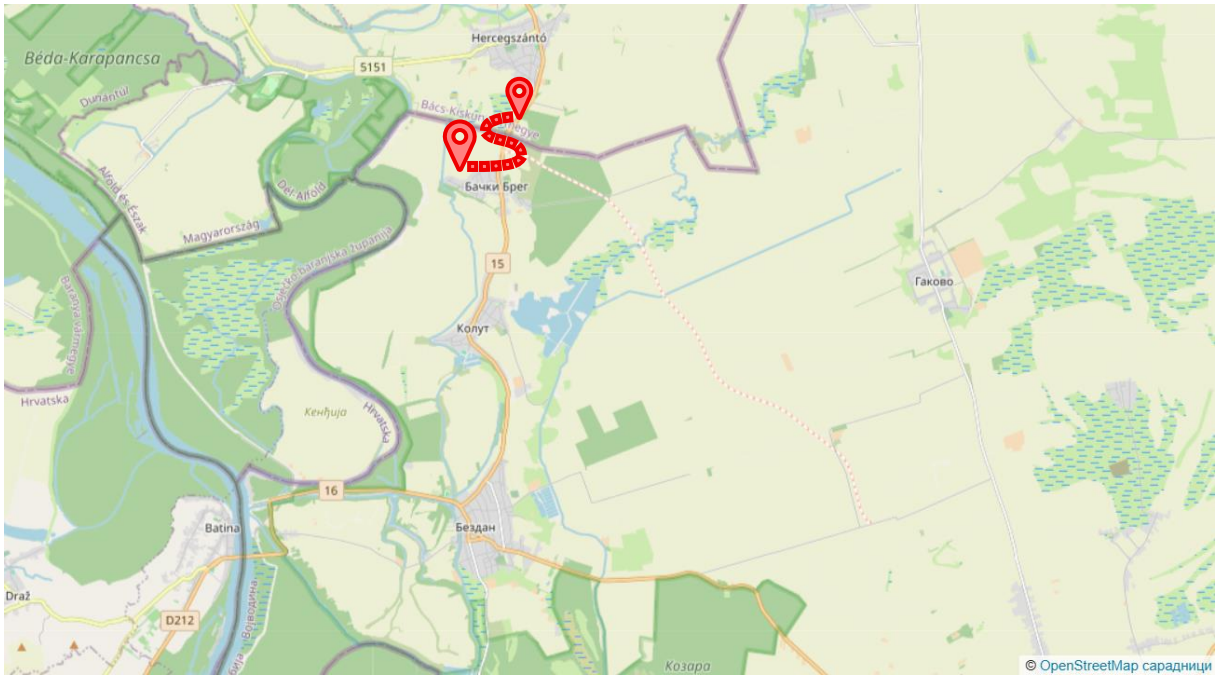


Figure 3-1 Location of the border crossing Bački Breg – Hercegszántó

## Rastina – Bácsszentgyörgy

Located in western Bačka, the crossing connects the border settlements of the Sombor municipality with the southern part of the Bács–Kiskun region in Hungary, with local links towards Sombor and Bački Breg. Access is via the local road network that connects to regional routes in the Sombor area; functionally, the crossing relieves the primary gateways in the corridor towards Kelebija and Horgoš.

Table 3-2 Basic characteristics of the border crossing Rastina – Bácsszentgyörgy

| Parameter | Description |
|---|---|
| Abbreviation | BSZGY - R |
| Operating hours | 07:00 – 19:00 |
| Number of exit lanes for passenger traffic | 1 |
| Permitted passenger categories | Citizens of SRB, HUN, EU Member States, CHE, NOR, ISL |
| Type of traffic | Passenger traffic |
| Traffic-status cameras available | No |

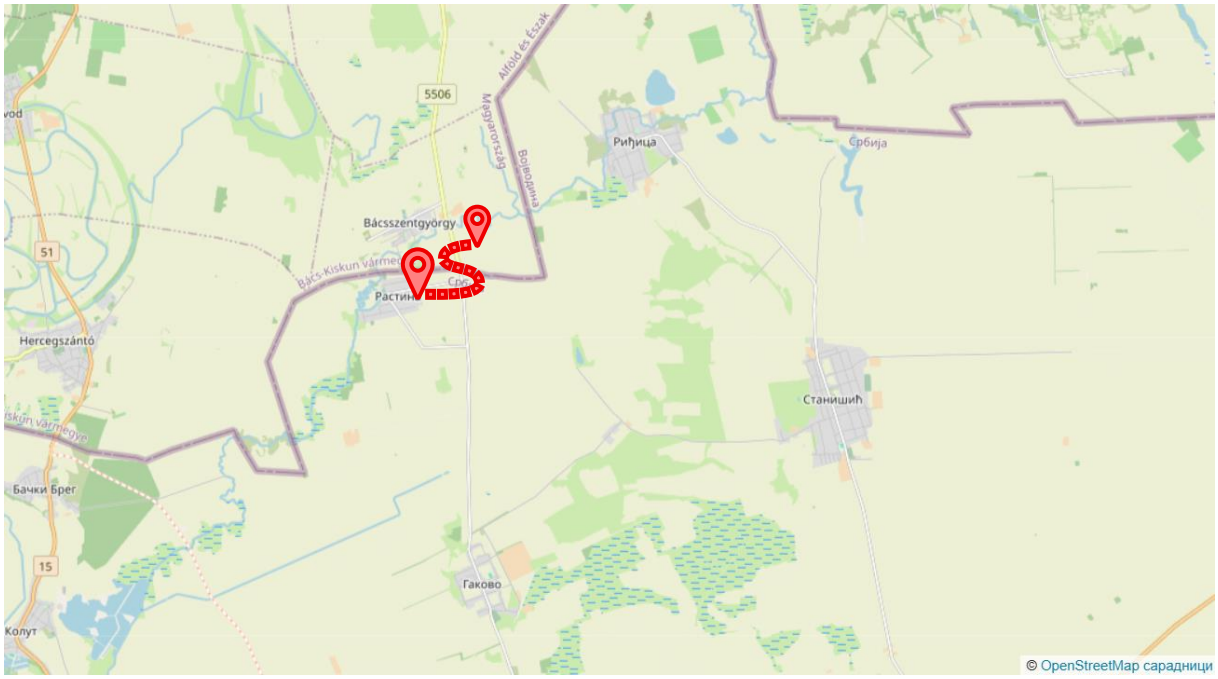


Figure 3-2 Location of the border crossing Rastina – Bácsszentgyörgy

## Bajmok – Bácsalmás

The crossing is located in northern Bačka, in the wider Subotica area, with links towards Bajmok and Bačka Topola, and towards Bácsalmás in Hungary. It lies on State Road IIA-105, which connects the border area near Bajmok with the interior of Vojvodina and further towards Banat, while on the Hungarian side access is via local road no. 5312.

Table 3-3 Basic characteristics of the border crossing Bajmok – Bácsalmás

| Parameter | Description |
|---|---|
| Abbreviation | BAJMOK - BA |
| Operating hours | 07:00 – 19:00 |
| Number of exit lanes for passenger traffic | 2 |
| Permitted passenger categories | Citizens of SRB, HUN, EU Member States, CHE, NOR, ISL |
| Type of traffic | Passenger traffic |
| Traffic-status cameras available | No |

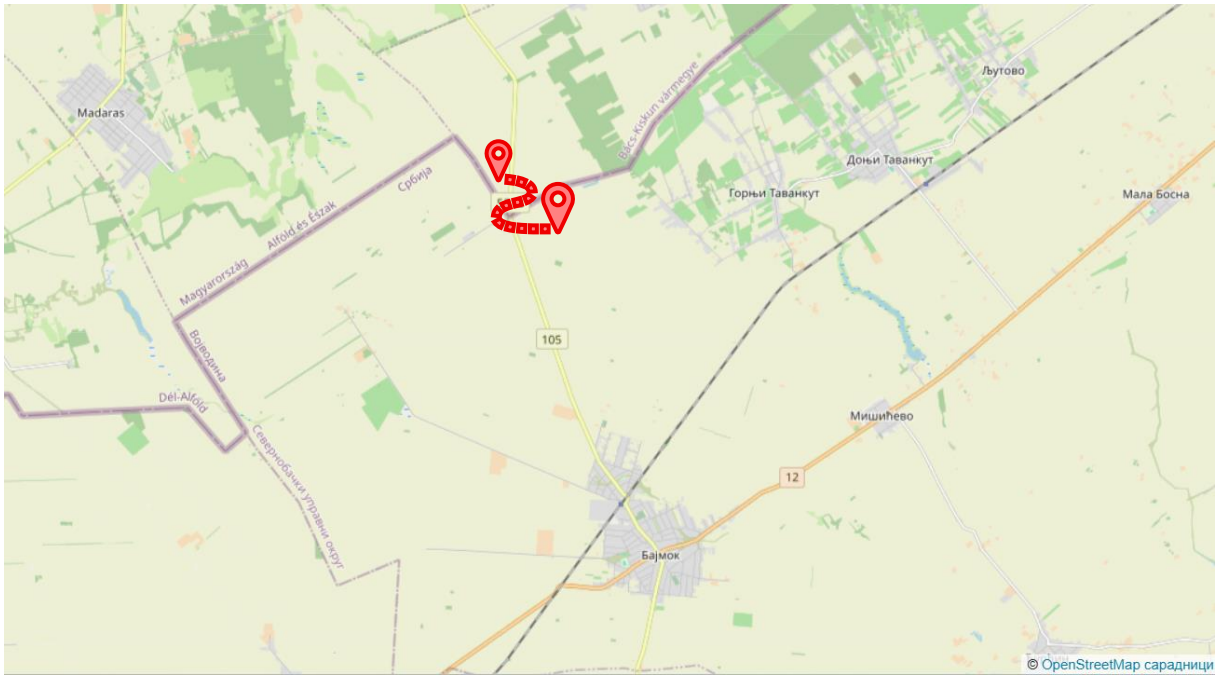


Figure 3-3 Location of the border crossing Bajmok – Bácsalmás

## Kelebija – Tompa

The border crossing north of Subotica represents the primary link to Tompa and further to the M5 corridor in Hungary. On the Serbian side, the access road is State Road IB-11 (Kelebija – Subotica), which connects the crossing with the A1 interchange near Subotica and the regional network of Bačka.

Table 3-4 Basic characteristics of the border crossing Kelebija – Tompa

| Parameter | Description |
|---|---|
| Abbreviation | K - T |
| Operating hours | 00:00 – 24:00 |
| Number of exit lanes for passenger traffic | 2 |
| Permitted passenger categories | Citizens of all countries |
| Type of traffic | Passenger and road freight traffic (3.5 t) |
| Traffic-status cameras available | Yes |

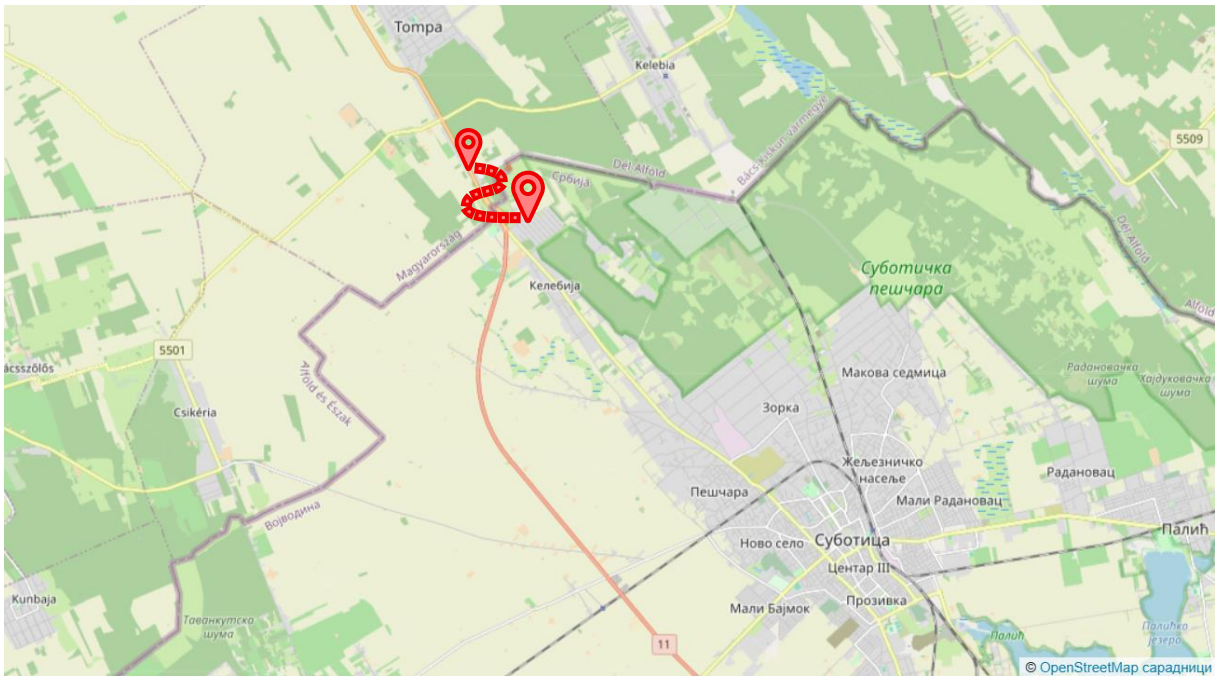


Figure 3-4 Location of the border crossing Kelebija – Tompa


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Figure 3-5 View from video cameras at the Kelebija – Tompa border crossing

*Source: Ministry of Interior of the Republic of Serbia (mup.gov.rs)*

## Horgoš – Röszke

At the very entry/exit of Motorway A1 (E75), this gateway connects northern Bačka with Szeged and Hungary's national network. The crossing is the terminus of Motorway A1 at the state border near Horgoš, providing a direct north–south transit axis through Serbia.

Table 3-5 Basic characteristics of the border crossing Horgoš – Röszke

| **Parameter** | **Description** |
|---|---|
| Abbreviation | H1 - R1 |
| Operating hours | 00:00 – 24:00 |
| Number of exit lanes for passenger traffic | 6 |
| Permitted passenger categories | Citizens of all countries |
| Type of traffic | Passenger and road freight traffic (3.5 t) |
| Traffic-status cameras available | Yes |

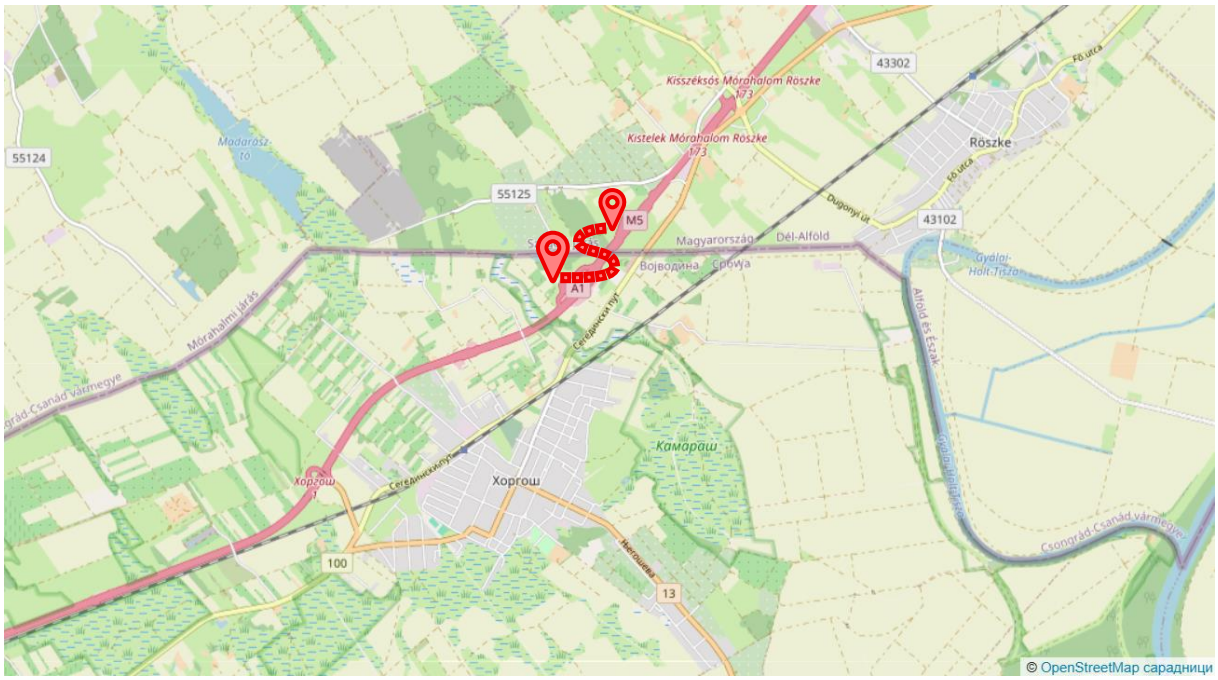


Figure 3-6 Location of the border crossing Horgoš – Röszke

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Камера ИЗЛА3

Figure 3-7 View from video cameras at the Horgoš – Röszke border crossing

*Source: Ministry of Interior of the Republic of Serbia (mup.gov.rs)*

## Horgoš 2 – Röszke

A parallel crossing within the Horgoš corridor connects the settlement of Horgoš and the local road network with the approach to Röszke 2. On the Serbian side, access is via State Road IIA-100 (Horgoš – Batajnica), which enables the diversion of local and seasonal flows away from the motorway.

Table 3-6 Basic characteristics of the border crossing Horgoš 2 – Röszke

| **Parameter** | **Description** |
|---|---|
| Abbreviation | H2 – R2 |
| Operating hours | 04:00 – 23:00 |
| Number of exit lanes for passenger traffic | 1 |
| Permitted passenger categories | Citizens of SRB, HUN, EU Member States, CHE, NOR, ISL |
| Type of traffic | Passenger traffic |
| Traffic-status cameras available | No |

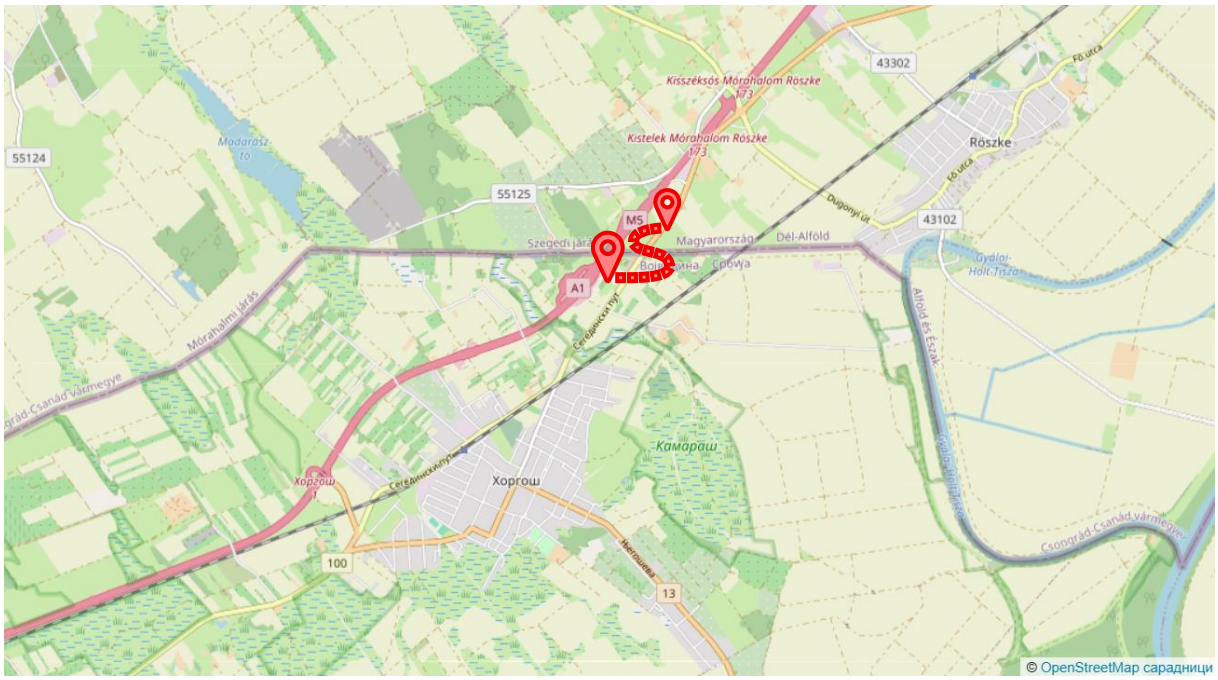


Figure 3-8 Location of the border crossing Horgoš 2 – Röszke

## Bački Vinogradi – Ásotthalom

The crossing serves to connect the settlements of northern Bačka (Subotica municipality) with Ásotthalom in Hungary and the local network south of Szeged. It is located on State Road IIA-101, which by a short spur links the crossing with the arterial route IIA-100 in the hinterland.

Table 3-7 Basic characteristics of the border crossing Bački Vinogradi – Ásotthalom

| **Parameter** | **Description** |
|---|---|
| Abbreviation | BV - A |
| Operating hours | 07:00 – 19:00 |
| Number of exit lanes for passenger traffic | 2 |
| Permitted passenger categories | Citizens of SRB, HUN, EU Member States, CHE, NOR, ISL |
| Type of traffic | Passenger traffic |
| Traffic-status cameras available | No |

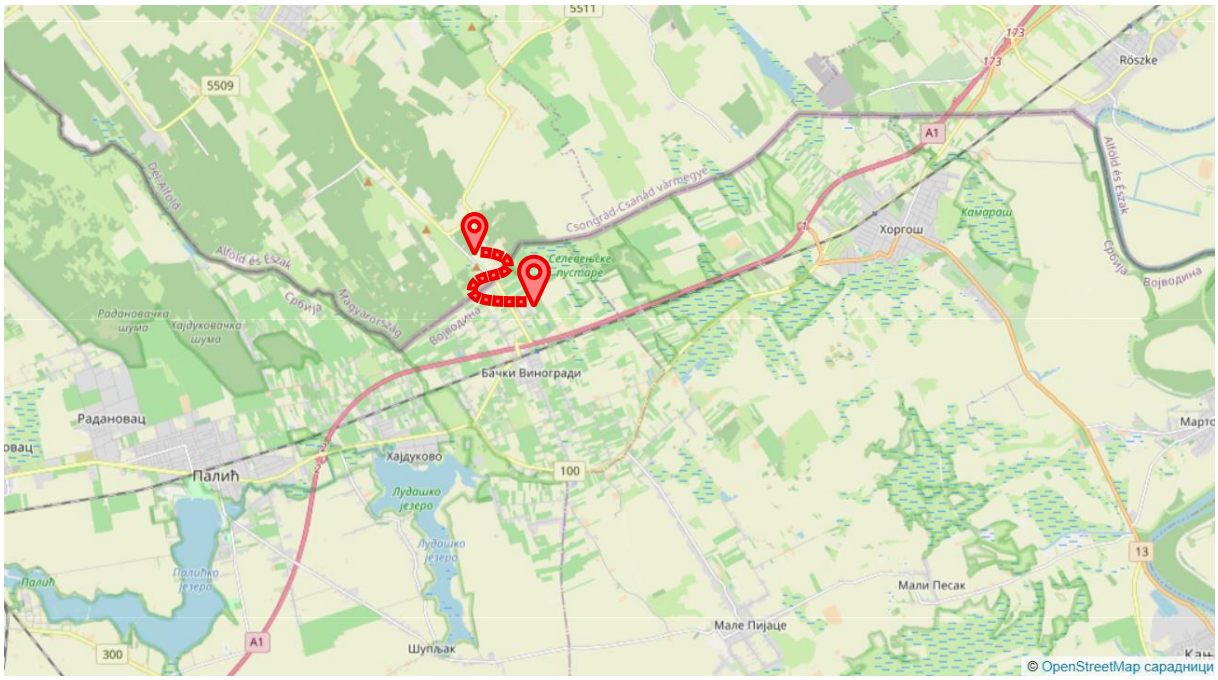


Figure 3-9 Location of the border crossing Bački Vinogradi – Ásotthalom

## Đala – Tiszasziget

The border point in the northeastern part of Vojvodina connects the Municipality of Kanjiža (the settlement of Đala and its surroundings) with Tiszasziget and the southern fringe of Szeged. Access on the Serbian side is via the local road network, which further gravitates towards Kikinda/Senta and the junctions of regional state roads in Banat.

Table 3-8 Basic characteristics of the border crossing Đala – Tiszasziget

| **Parameter** | **Description** |
|---|---|
| Abbreviation | GJ - TSZ |
| Operating hours | 07:00 – 19:00 |
| Number of exit lanes for passenger traffic | 3 |
| Permitted passenger categories | Citizens of SRB, HUN, EU Member States, CHE, NOR, ISL |
| Type of traffic | Passenger traffic |
| Traffic-status cameras available | Yes |

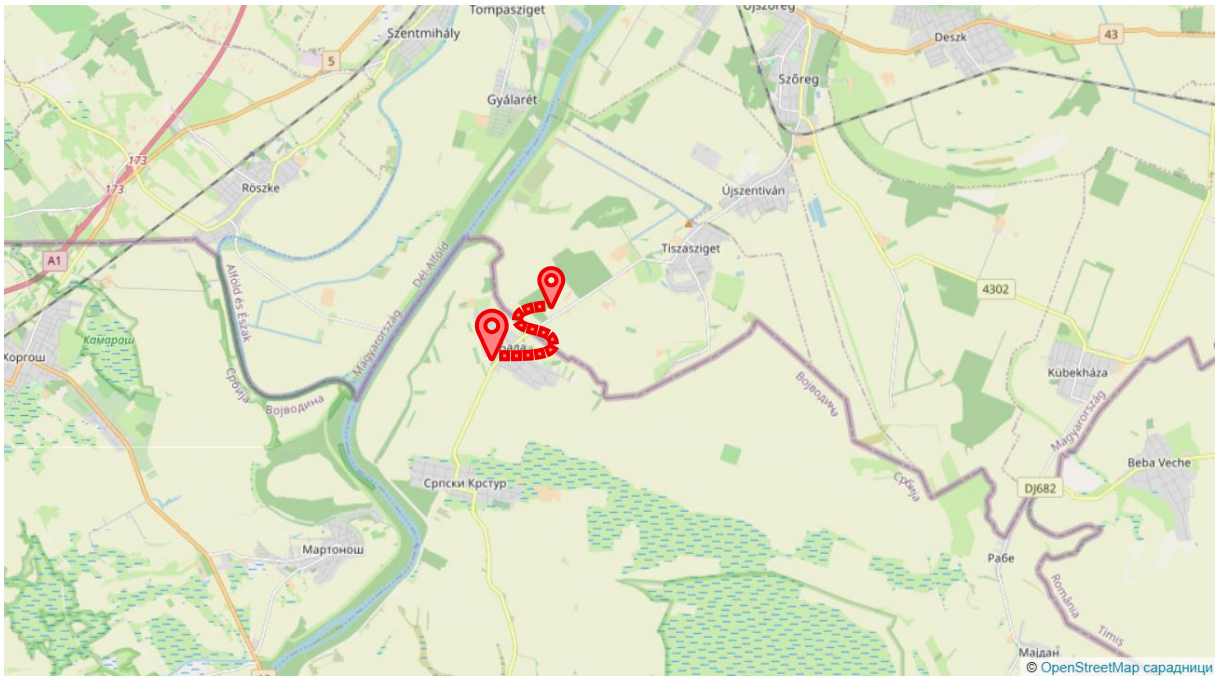


Figure 3-10 Location of the border crossing Đala – Tiszasziget


Камера УЛА3 Камера ИЗЛА3

Figure 3-11 View from video cameras at the Đala – Tiszasziget border crossing

*Source: Ministry of Interior of the Republic of Serbia (mup.gov.rs)*

## Rabe – Kübekháza

At the tri-border of Serbia, Hungary, and Romania, the crossing connects the settlement of Rabe (Municipality of Novi Kneževac) with Kübekháza and the southern riparian zone of the Mureș/Maros. On the Serbian side, access is via State Road IIB-302 (Rabe – state border section), which was rehabilitated to establish the joint border crossing and to link with the regional road network of Banat.

Table 3-9 Basic characteristics of the border crossing Rabe – Kübekháza

| **Parameter** | **Description** |
|---|---|
| Abbreviation | R - K |
| Operating hours | 07:00 – 19:00 |
| Number of exit lanes for passenger traffic | 2 |
| Permitted passenger categories | Citizens of SRB, HUN, EU Member States, CHE, NOR, ISL |
| Type of traffic | Passenger traffic |
| Traffic-status cameras available | No |

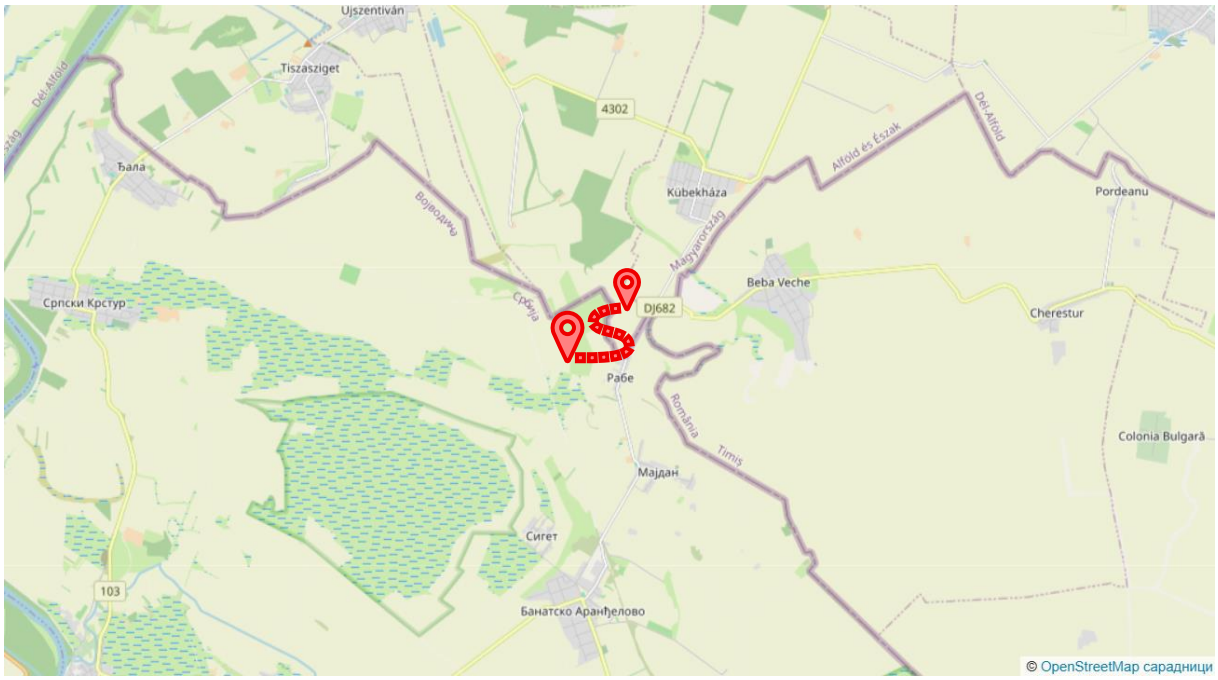


Figure 3-12 Location of the border crossing Rabe – Kübekháza

# 4. ANALYSIS OF TRAFFIC-FLOW CHARACTERISTICS

For the purpose of analysing traffic flow characterestics, data was collected from active automatic traffic counters on the state roads connected to the observed border crossings. The vehicle flow data obtained from the automatics counters were provided by the Public Enterprise Roads of Serbia (JP Putevi Srbije). In addition to the data from the automatic traffic counters, data on outbound vehicle and passenger flows at all border crossings were analyzed, based on datasets provided by the Ministry of Interior of the Republic of Serbia – Border Police Directorate.

## 4.1. Border Traffic of Passenger Motor Vehicles and Passengers

The results regarding the border traffic of passenger motor vehicles and passengers between the Republic of Serbia and the Republic of Hungary are presented based on data published in the quarterly bulletins of the Statistical Office of the Republic of Serbia – Transport and Telecommunications Statistics[1]. Quarterly data are provided for the year 2024, while for 2023 and 2022, the data are shown at the annual level.

Table 4-1 Entry of passenger motor vehicles (excluding local border traffic) – comparative data by quarters for 2023 and 2024.

| | Entry | | | | Entry | | | | Index |
|---|---|---|---|---|---|---|---|---|---|
| | **Total** | **Passenger Cars** | **Buses** | **Motorcycles** | **Total** | **Passenger Cars** | **Buses** | **Motorcycles** | **2024 / 2023** |
| Total | 1377986 | 1354779 | 23061 | 146 | 1416156 | 1391516 | 24376 | 264 | 102,8 |
| | **I quarter 2023** | | | | **I quarter 2024** | | | | |
| Towards Hungary | 198927 | 192851 | 6076 | - | 200331 | 193499 | 6830 | 2 | 100,7 |
| Of wich: | | | | | | | | | |
| Horgoš | 131729 | 127280 | 4449 | - | 139870 | 134483 | 5387 | - | 106,2 |
| Kelebia | 48870 | 47437 | 1433 | - | 48518 | 47150 | 1368 | - | 99,3 |
| Other | 18328 | 18134 | 194 | - | 11943 | 11866 | 75 | 2 | 65,2 |
| | **II quarter 2023** | | | | **II quarter 2024** | | | | |
| Towards Hungary | 351746 | 343870 | 7841 | 35 | 310373 | 302360 | 8008 | 5 | 88,2 |
| Of wich: | | | | | | | | | |
| Horgoš | 196521 | 190663 | 5858 | - | 178417 | 172108 | 6309 | - | 90,8 |
| Kelebia | 29736 | 29736 | - | - | 44675 | 44675 | - | - | 150,2 |
| Other | 102229 | 100445 | 1784 | - | 70396 | 68799 | 1597 | - | 68,9 |
| Towards Hungary | 23260 | 23026 | 199 | 35 | 16885 | 16778 | 102 | 5 | 72,6 |
| | **III quarter 2023** | | | | **III quarter 2024** | | | | |
| Towards Hungary | 523659 | 514037 | 9564 | 58 | 570184 | 560449 | 9690 | 45 | 108,9 |
| Of wich: | | | | | | | | | |
| Horgoš | 347603 | 340458 | 7145 | - | 319442 | 311822 | 7620 | - | 91,9 |

[1] Statistical Office of the Republic of Serbia; https://www.stat.gov.rs/oblasti/saobracaj-i-telekomunikacije/ ; accessed 12.3.2025.

| | Entry | | | | Entry | | | | Index |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Passenger Cars | Buses | Motorcycles | Total | Passenger Cars | Buses | Motorcycles | 2024/2023 |
| Kelebia | 102406 | 100349 | 2057 | - | 175027 | 173011 | 2016 | - | 170,9 |
| Other | 73650 | 73230 | 362 | 58 | 75715 | 75616 | 54 | 45 | 102,8 |
| | IV quarter 2023 | | | | IV quarter 2024 | | | | |
| Towards Hungary | 300435 | 293203 | 7232 | - | 290906 | 284141 | 6763 | 2 | 96,8 |
| Of wich: | | | | | | | | | |
| Horgoš | 176043 | 170794 | 5249 | - | 157263 | 152377 | 4886 | - | 89,3 |
| Kelebia | 64070 | 62370 | 1700 | - | 68694 | 67146 | 1548 | - | 107,2 |
| Other | 60322 | 60039 | 283 | - | 64949 | 64618 | 329 | 2 | 107,7 |

Table 4-2 Exit of passenger motor vehicles (excluding local border traffic) – comparative data by quarters for 2023 and 2024.

| | Exit | | | | Exit | | | | Index |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Passenger Cars | Buses | Motorcycles | Total | Passenger Cars | Buses | Motorcycles | 2024/2023 |
| Total | 1367138 | 1344266 | 22735 | 137 | 1405825 | 1381926 | 23509 | 390 | 102,8 |
| | I quarter 2023 | | | | I quarter 2024 | | | | |
| Towards Hungary | 223557 | 217501 | 6056 | - | 215545 | 208924 | 6619 | 2 | 96,4 |
| Of wich: | | | | | | | | | |
| Horgoš | 132623 | 128943 | 3680 | - | 142287 | 137667 | 4620 | - | 107,3 |
| Kelebia | 62363 | 60372 | 1991 | - | 59268 | 57434 | 1834 | - | 95,0 |
| Other | 28571 | 28186 | 385 | - | 13990 | 13823 | 165 | 2 | 49,0 |
| | II quarter 2023 | | | | II quarter 2024 | | | | |
| Towards Hungary | 352533 | 344865 | 7647 | 21 | 262821 | 255265 | 7528 | 28 | 74,6 |
| Of wich: | | | | | | | | | |
| Horgoš | 221700 | 216770 | 4930 | - | 132132 | 126764 | 5368 | - | 59,6 |
| Kelebia | 31117 | 31117 | - | - | 43505 | 43505 | - | - | 139,8 |
| Other | 78568 | 76302 | 2266 | - | 69414 | 67404 | 2010 | - | 88,3 |
| Towards Hungary | 21148 | 20676 | 451 | 21 | 17770 | 17592 | 150 | 28 | 84,0 |
| | III quarter 2023 | | | | III quarter 2024 | | | | |
| Towards Hungary | 590353 | 580583 | 9743 | 27 | 567938 | 555975 | 11916 | 47 | 96,2 |
| Of wich: | | | | | | | | | |
| Horgoš | 391378 | 384873 | 6505 | - | 335671 | 326579 | 9092 | - | 85,8 |
| Kelebia | 118905 | 116170 | 2735 | - | 108710 | 105948 | 2762 | - | 91,4 |
| Other | 80070 | 79540 | 503 | 27 | 123557 | 123448 | 62 | 47 | 154,3 |
| | IV quarter 2023 | | | | IV quarter 2024 | | | | |
| Towards Hungary | 256032 | 248552 | 7480 | - | 242471 | 235592 | 6879 | - | 94,7 |
| Of wich: | | | | | | | | | |
| Horgoš | 131452 | 126598 | 4854 | - | 121601 | 117439 | 4162 | - | 92,5 |
| Kelebia | 70309 | 68069 | 2240 | - | 62386 | 60123 | 2263 | - | 88,7 |
| Other | 54271 | 53885 | 386 | - | 58484 | 58030 | 454 | - | 107,8 |

Table 4-3 Passenger Vehicle Traffic by Border Crossings in 2023

| | Entry | | | | Exit | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | Passenger Cars | Buses | Motorcycles | Total | Passenger Cars | Buses | Motorcycles |
| Total – All Countries | 7918348 | 7792735 | 121662 | 3951 | 7987373 | 7861840 | 120867 | 4666 |
| Republic of Hungary | 1404543 | 1373737 | 30713 | 93 | 1452770 | 1421796 | 30926 | 48 |
| Bački Breg | 91783 | 90745 | 1038 | / | 98080 | 96355 | 1725 | / |
| Vrbica | 7494 | 7401 | / | 93 | 7794 | 7746 | / | 48 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Horgoš II | 135795 | 135795 | / | / | 139598 | 139598 | / | / |
| Kelebija | 317575 | 310601 | 6974 | / | 330145 | 320913 | 9232 | / |

Табела 4-1 Passenger Traffic by Type of Passenger Vehicle in 2023

| | Entry | | | | Exit | | | |
|---|---|---|---|---|---|---|---|---|
| | **Total** | **Passenger Cars** | **Total** | **Passenger Cars** | **Total** | **Passenger Cars** | **Total** | **Passenger Cars** |
| Total – All Countries | 17302709 | 14497639 | 2800298 | 4772 | 16925708 | 14215047 | 2705188 | 5473 |
| Republic of Hungary | 3296037 | 2625382 | 670535 | 120 | 3208953 | 2564891 | 644007 | 55 |

Table 4-4 Passenger Vehicle Traffic by Border Crossings in 2022

| | Entry | | | | Exit | | | |
|---|---|---|---|---|---|---|---|---|
| | **Total** | **Passenger Cars** | **Buses** | **Motorcycles** | **Total** | **Passenger Cars** | **Buses** | **Motorcycles** |
| Total – All Countries | 8342398 | 8214844 | 122771 | 4783 | 8084320 | 7956140 | 121994 | 6188 |
| Republic of Hungary | 1328746 | 1301270 | 27427 | 49 | 1224637 | 1197539 | 27065 | 33 |
| Bački Breg | 79600 | 78896 | 704 | - | 85209 | 83941 | 1268 | - |
| Vrbica | 7585 | 7536 | - | 49 | 7358 | 7325 | - | 33 |
| Horgoš II | 932357 | 911564 | 20793 | - | 788854 | 770570 | 18284 | - |
| Kelebija | 309204 | 303274 | 5930 | - | 343216 | 335703 | 7513 | - |

Table 4-5 Passenger Traffic by Type of Passenger Vehicle in 2022

| | Entry | | | | Exit | | | |
|---|---|---|---|---|---|---|---|---|
| | **Total** | **Passenger Cars** | **Total** | **Passenger Cars** | **Total** | **Passenger Cars** | **Total** | **Passenger Cars** |
| Total – All Countries | 17354898 | 14581788 | 2766531 | 6579 | 16033106 | 13419617 | 2608949 | 4537 |
| Republic of Hungary | 3233194 | 2596190 | 636951 | 53 | 2916733 | 2314700 | 601998 | 35 |

## 4.2. Traffic volume on the state road network

Automatic traffic counters perform vehicle detection and classification in real time, 24 hours a day, 365 days a year. Within this study, data from five automatic counters located in the immediate vicinity of the state border with the Republic of Hungary were analyzed. Observed from west to east, the following counters were included:

- ATC 2022 Bački Breg,
- ATC 2099 Bajmok 2,
- ATC 2090 Horgoš 2AP,
- ATC 2095 Horgoš 2 и
- ATC 2085 Đala.

Figure 4-1 shows the locations of the analyzed counters.

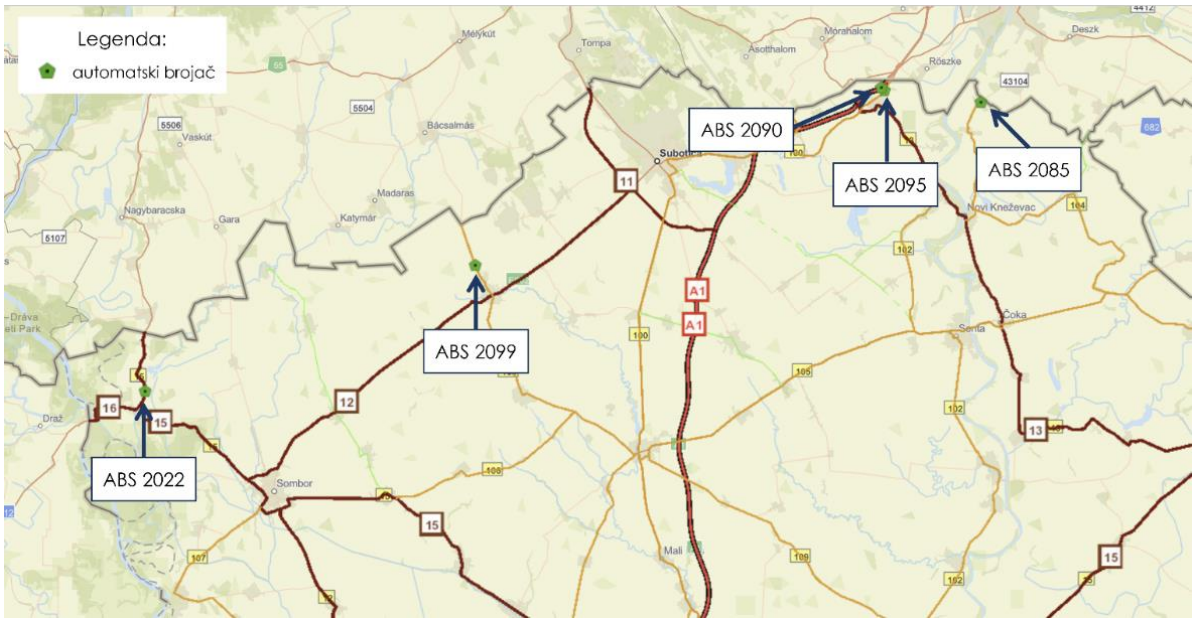


Figure 4-1 Locations of the analyzed automatic traffic counters located in the border area with the Republic of Hungary

*Source: GIS Portal of the Public Enterprise „Roads of Serbia", https://gisportal.rs/smartPortal/gisjpps; accessed 22.09.2025.*

In the following, an analysis is carried out by counting locations and vehicle composition. Only traffic in the direction towards the border with the Republic of Hungary is analysed. For the purposes of the study, data were analysed for the period from 01.07.2024 to 31.08.2025, with special emphasis on the defined reference periods.

Table 4-2 presents the vehicle structure adopted for the purpose of the analysis, including the vehicle categories recorded by the traffic counters and their descriptions. Passengers cars (PC) include vehicle categories A0, A1, A2 and X. Freight vehicles (FV) comprise categories B1 through B5, while buses (BUS) include categories C1 and C2.

Table 4-2 Vehicle structure and categories

| No. | Vehicle structure | Counter vehicle category | Description |
|---|---|---|---|
| 1 | PC | A0 | Motorcycles |
| 2 | | A1 | Passenger cars and |
| | | | Passenger cars with trailers |
| 3 | | A2 | Combination vehicles and |
| | | | Combination vehicles with trailers |
| 4 | FV | B1 | Light freight vehicles and |
| | | | Light freight vehicles with trailers |
| 5 | | B2 | Medium heavy freight-vehicles |
| 6 | | B3 | Heavy freight vehicles |
| 7 | | B4 | Heavy freight vehicles with trailers |
| 8 | | B5 | Truck tractors with semi-trailers |
| 9 | BUS | C1 | Buses |
| 10 | | C2 | Articulated buses |
| 11 | PC | X | Uncategorized (other) vehicles |

### 4.2.1. Automatic Traffic Counter 2022 – Bački Breg

Automatic traffic counter 2022 is installed on the state road IB, on the section Bezdan – Bački Breg. The counter is located approximately 7km from from the Bački Breg border crossing. This road section represents the main acces route to the border crossing, with several local and regional roads connecting to it.

The counter records the data on vehicle composition and flow in both traffic directions:

- Direction 1: Bezdan – Bački Breg (border crossing with Hungary),
- Direction 2: Bački Breg (Border crossing with Hungary) – Bezdan.

For the purpose of this study, detailed analysis was performed for Direction 1.

Figure 4-2 shows the daily distribution of vehicle flow and categories for the analyzed period. The total daily flow is dominated by passenger cars, with pronounced variations during seasonal periods i.e. during the summer months and at the beginning of the year. The average number of passenger cars during the observed period amounts to 1,014 PC/day, while during the summer month the flow reaches up to 2,980 PC/day. Freight vehicles and buses maintain a stable and significantly lower intensity, with values ranging from 8 to 169 FV/day and from 1 to 27 BUS/day.

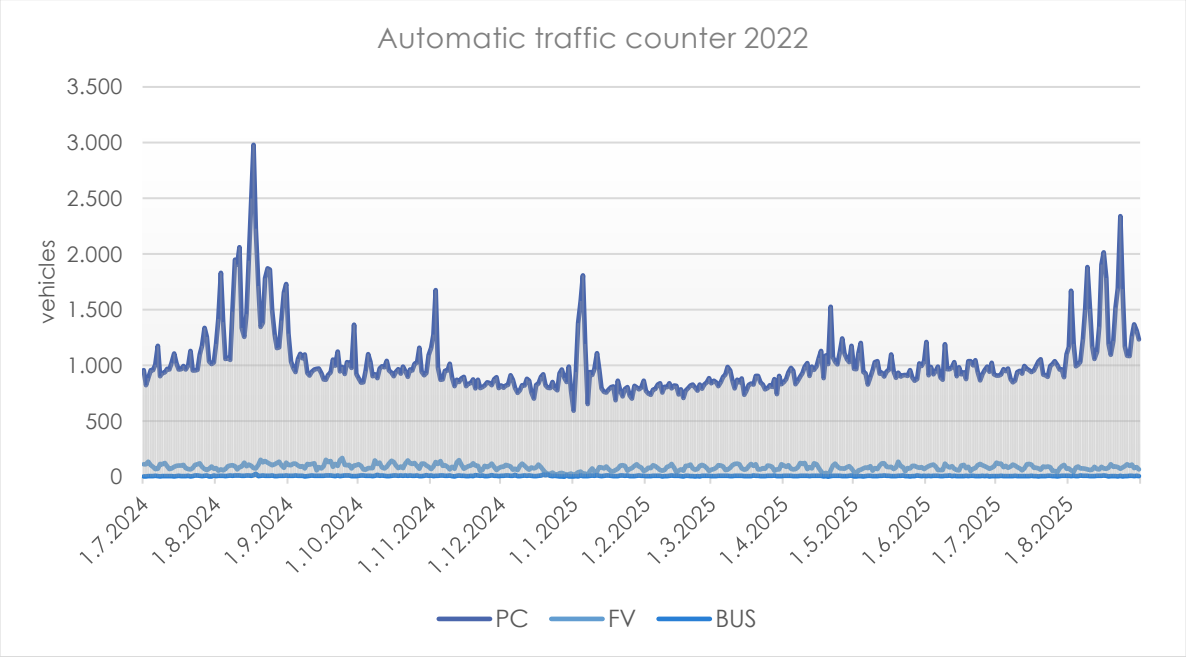


Figure 4-2 Distribution of vehicle flow and category by day at the location of the automatic traffic counter 2022 – Bački Breg

#### Traffic Analysis during Reference Periods (ATC 2022)

The average vehicle flow within the defined reference periods amounted to 1,097 vehicles per day. Significant fluctuations in intensity were observed during seasonal periods — from January 3 to 6 and August 23 to 24 — when flow values were more than twice the average, reaching up to 2,421 vehicles per day (Figure 4-3).

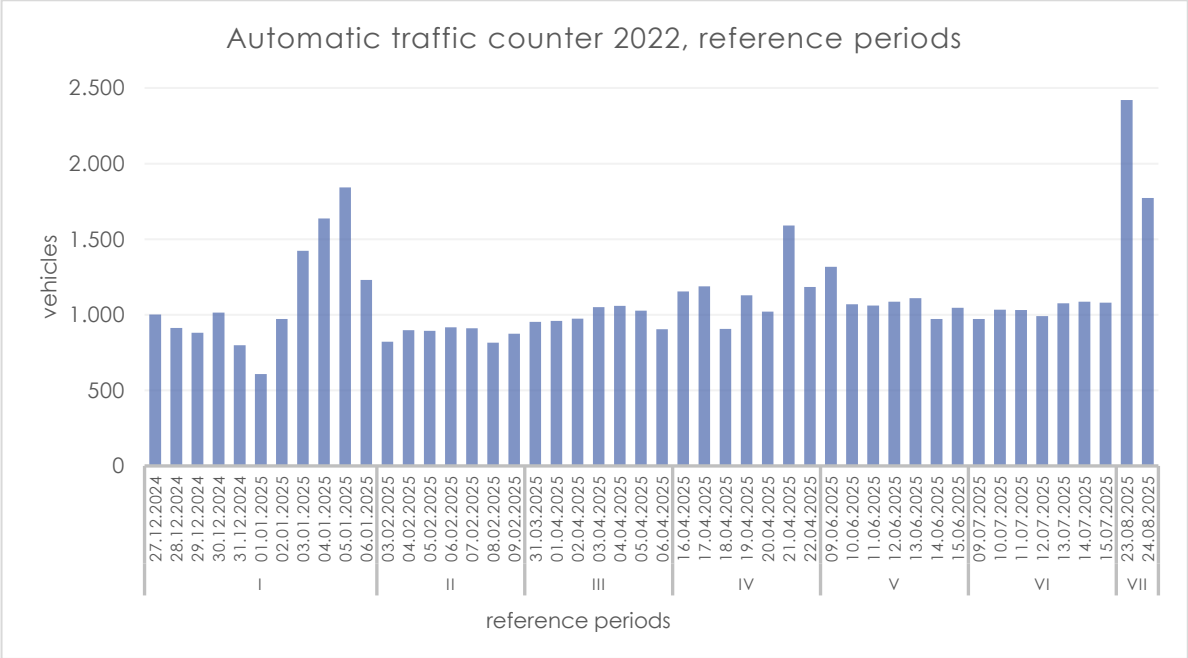


Figure 4-3 Distribution of vehicle flow by day at the location of the automatic traffic counter 2022 – Bački Breg, reference periods

Passenger vehicles dominate the overall traffic composition, with an average share of 93.1%. Slight variations were observed in certain periods, mainly due to the increased share of freight vehicles. On average, freight vehicles accounted for 6.3% and buses for 0.7% of the total flow composition (Figure 4-4).

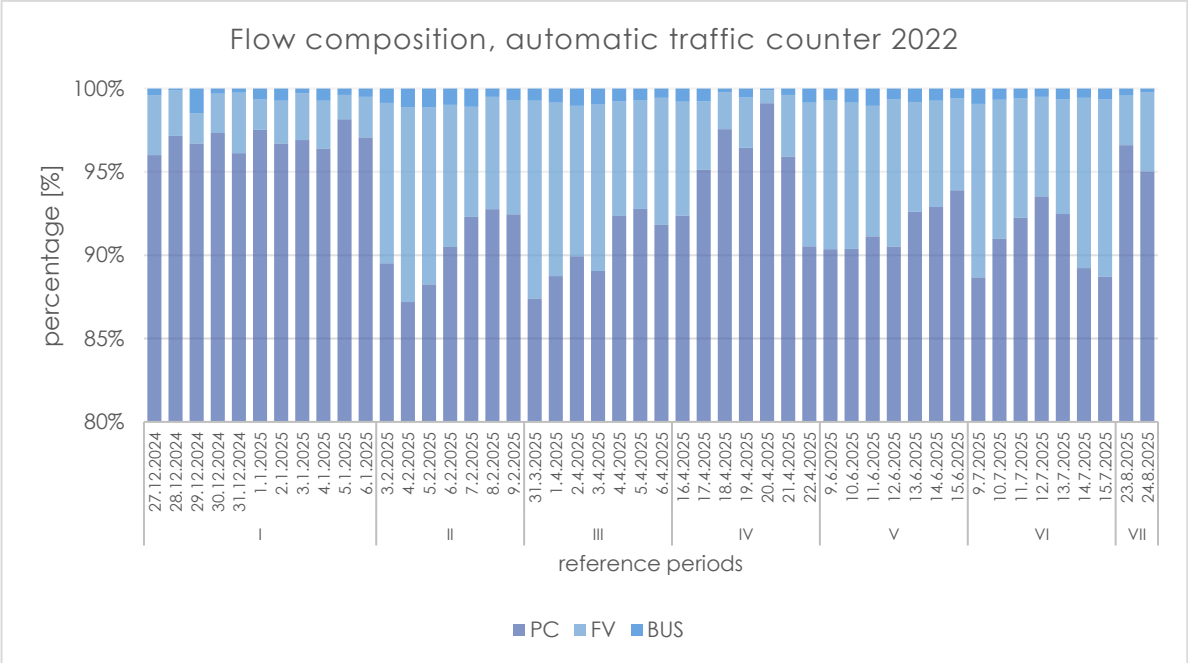


Figure 4-4 Daily traffic composition at the location of the automatic traffic counter 2022 – Bački Breg, reference periods

### 4.2.2. Automatic Traffic Counter 2099 Bajmok 2

Automatic traffic counter 2099, Bajmok 2, is installed on state road IIA, route 105. The counter is located approximately 4.5 km from the Bajmok border crossing. Since it is positioned on the only road section leading to the border crossing, all traffic crossing the border are recorded by this counter. The counter records the data on vehicle composition and flow in the following directions:

- Direction 1: border crossing – Bajmok,
- Direction 2: Bajmok – border crossing.

For the purposes of this study, detailed analysis was performed for Direction 2.

Passenger vehicles dominate the overall traffic composition, with an average daily value od 289 PC/day. Flow variations are most pronounced during the summer months and at the beginning of the year, when passenger car numbers reach values up to 5.37 times the average, i.e., up to 1,533 PC/day. Significant variation are also observed outside seasonal periods, as average weekend flows are approximately twice those of weekdays. On average, 5 FV/day were recorded, while buses were mostly absent during the observed period (Figure 4-5).

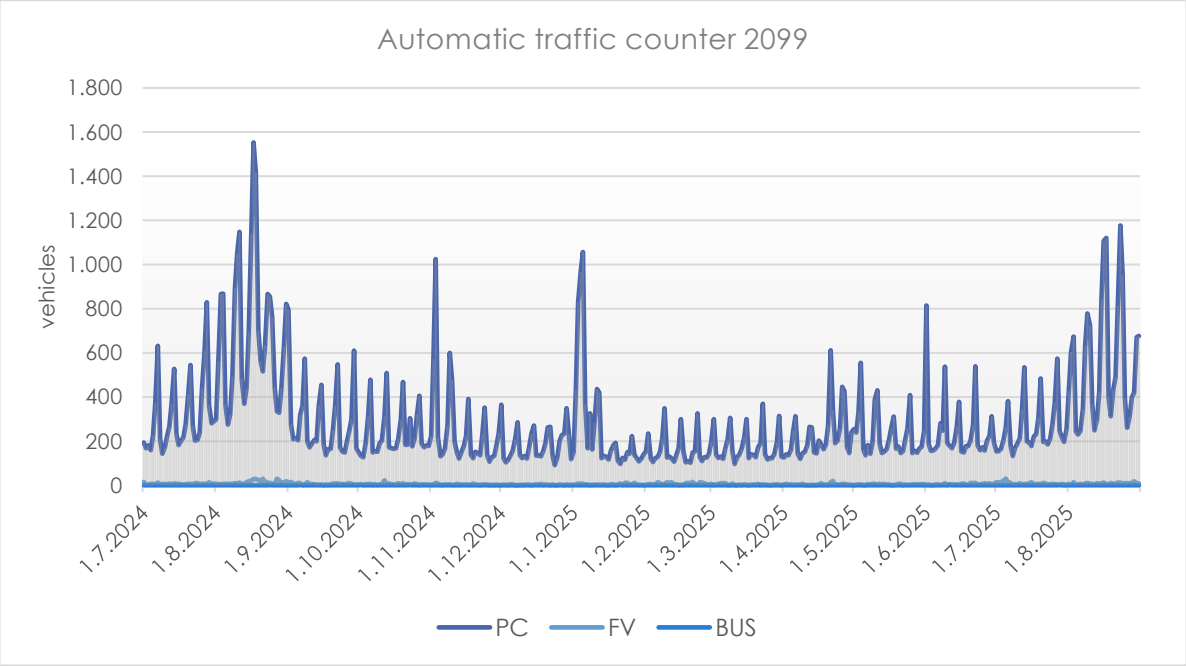


Figure 4-5 Distribution of vehicle flow and category by day at the location of the automatic traffic counter 2099 Bajmok 2

#### Traffic analysis during reference periods (ATC 2099)

The highest traffic intensity within the observed reference periods was recorded from January 3 to 5 and August 23 to 24, with an average of 1,005 vehicles/day. During other periods, significantly lower flow values were observed, with pronounced variations on weekends. The average flow within the observed reference periods amounted to 322 vehicles/day (Figure 4-6).

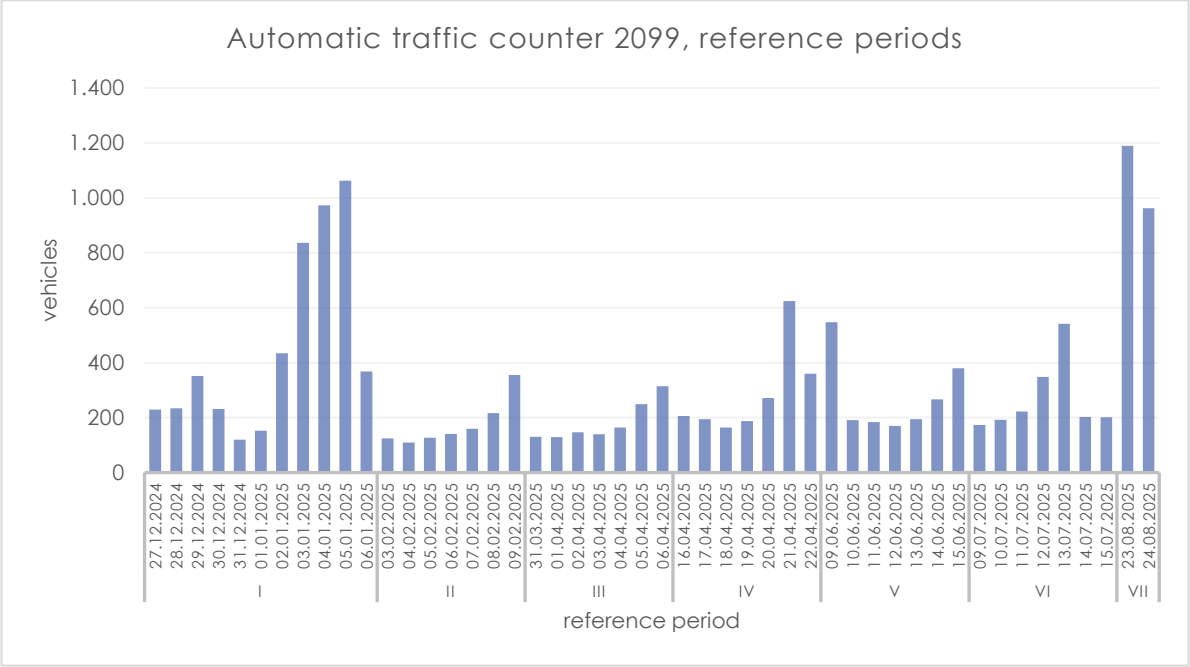


Figure 4-6 Distribution of vehicle flow by day at the location of the automatic traffic counter 2099 Bajmok 2, reference periods

Passenger vehicles dominate the overall traffic composition (average 98%), while freight vehicles account for approximately 2% (Figure 4-7).

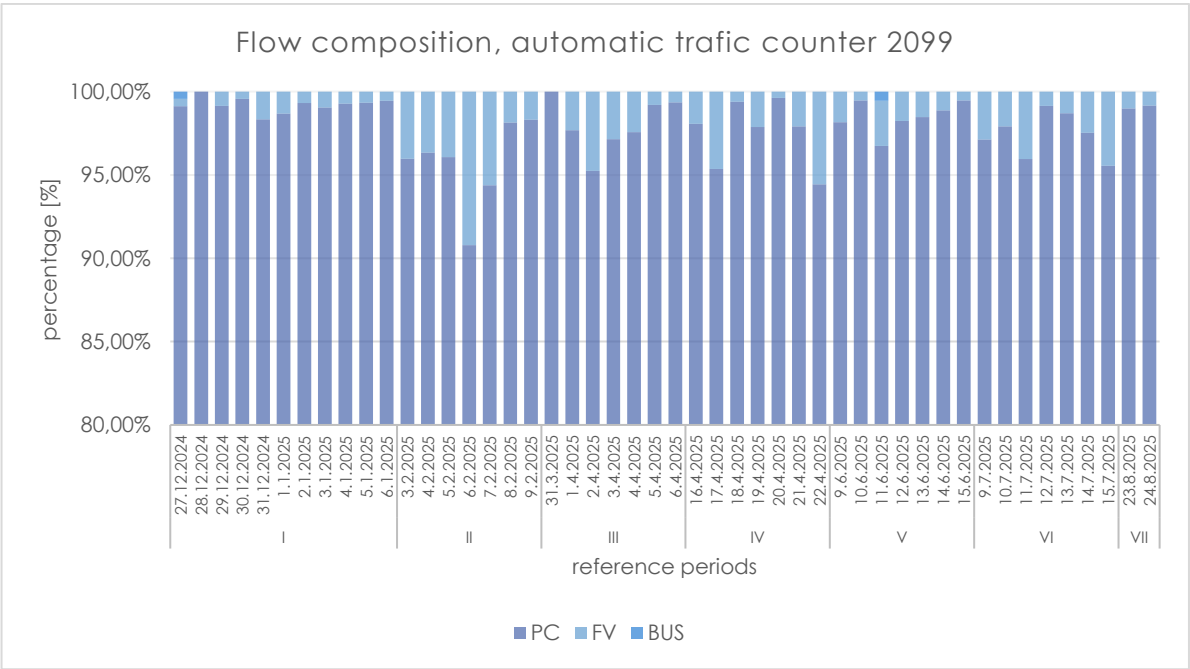


Figure 4-7 Daily traffic composition at the location of the automatic traffic counter 2099 – Bajmok 2, reference periods

### 4.2.1. Automatic Traffic Counter 2090 Horgoš 2 AP

Automatic traffic counter 2090 (Horgoš 2 AP) is installed on state road IA, section A1002. The counter is located approximately 1km from the Horgoš border crossing. All vehicles exiting the country through this crossing are recorded by this counter. The counter records the data on vehicle flow and composition in the direction Horgoš loop – border with Hungary, specifically for both the driving and overtaking lanes. The following analysis presents traffic for both lanes combined. On an average day, ATC 2090 records 2,595 passenger cars (PC), 529 freight vehicles (FV), and 52 buses (BUS). Pronounced flow variations of passenger vehicles were observed during the summer months (5,000-7,000 PC/day), at the beginning of the year (approximately 5,000 PC/day), and on April 21(around 5,000 vehicles/day). Freight vehicles and buses maintain a more stable but significantly lower intensity (Figure 4-8).

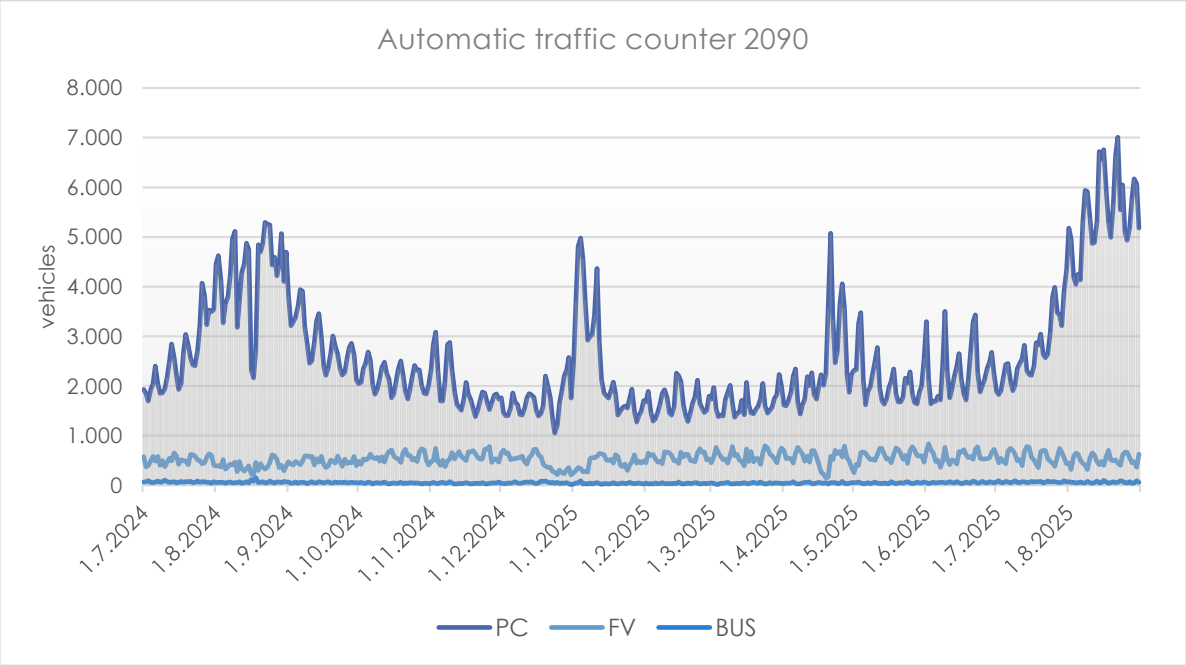


Figure 4-8 Distribution of vehicle flow and category by day at the location of the automatic traffic counter 2090 – Horgoš 2 AP

#### Traffic analysis during reference periods (ATC 2090)

Within the defined reference periods, the highest traffic intensity was recorded from January 2 to 6 (average 4,718 vehicles/day), on April 21 (5,711 vehicles/day), and from August 23 to 24 (average 6,388 vehicles/day). In other words, pronounced flow variations were observed during seasonal periods and the day following the religious holiday Easter. During the rest of the year, traffic intensity was significantly lower, ranging mostly between 2,000 and 3,000 vehicles/day (Figure 4-9).

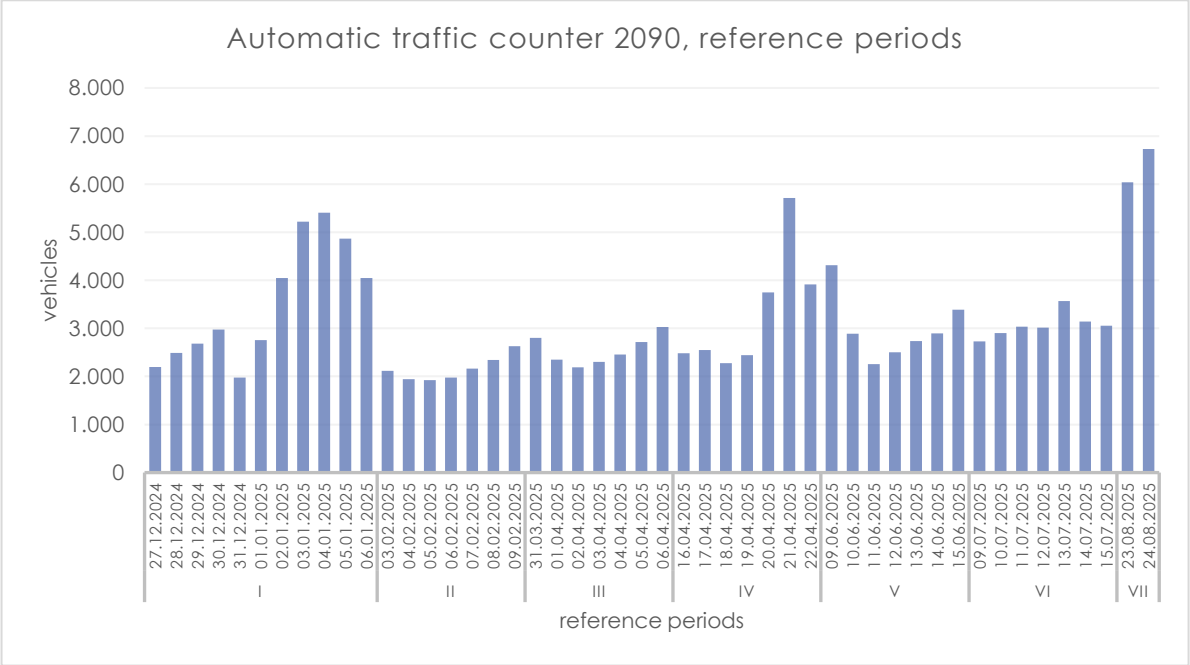


Figure 4-9 Distribution of daily vehicle flow at the location of automatic traffic counter 2090 - Horgoš 2 AP, reference periods

Passenger vehicles dominate the overall traffic composition during the defined reference periods, with an average share of 82%. Freight vehicles account for 17%, and buses for 2% (Figure 4-10).

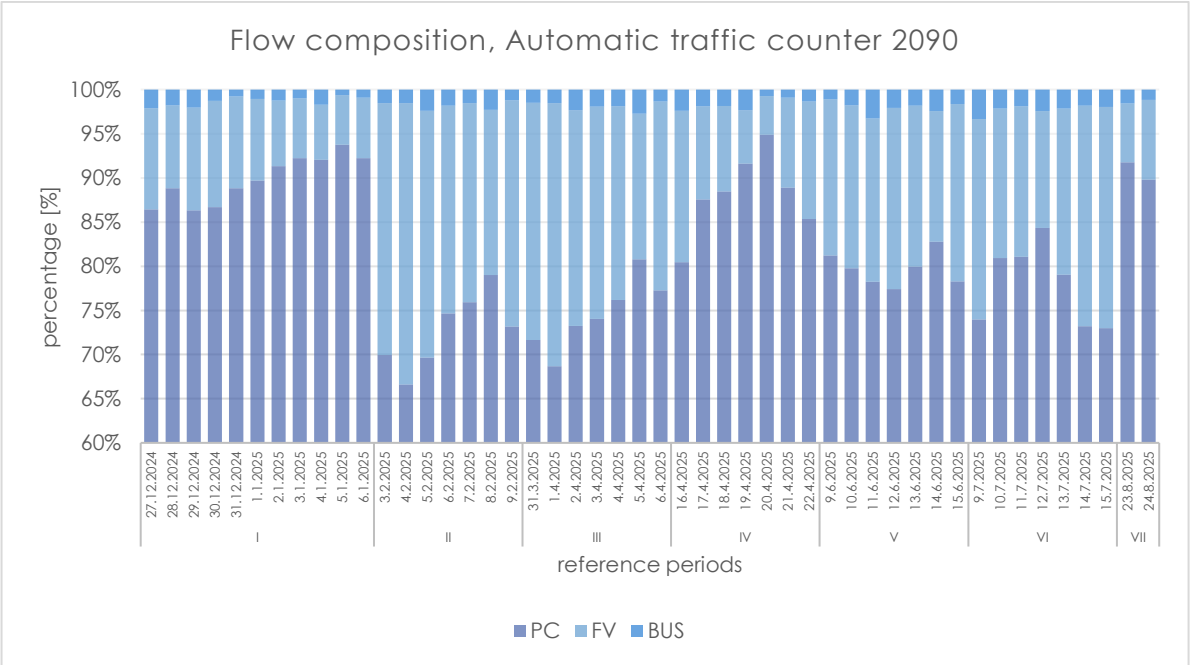


Figure 4-10 Daily traffic composition at the location of the automatic traffic counter 2090 Horgoš 2 AP, reference periods

### 4.2.2. Automatic Traffic Counter 2095 Horgoš 2

Automatic traffic counter 2095 (Horgoš 2) is installed on state road IIA, route 100, at the road segment 10001, approximately 1.3 km from the Horgoš 2 border crossing. The counter records the data on vehicle flow and composition in two directions:

- Direction 1: border crossing – Horgoš,
- Direction 2: Horgoš – border crossing.

All vehicles exiting the country through the Horgoš 2 border crossing are recorded by this counter. Therefore, the analysis below focuses on the data for direction 2; Horgoš – border crossing.

Figure 4-11 shows the number of passenger cars, freight vehicles, and buses recorded by the counter 2095 in direction 2, for the period from July 1, 2024, to August 31, 2025. Passenger cars dominate the overall flow structure, with an average of 1,048 PC/day. Flow variations are particularly evident during the summer season, when the number of passenger cars increases by up to 80% compared to the average (1,833 PC/day). Mild fluctuations are also observed outside the seasonal periods, as weekend traffic volumes are slightly higher than on weekdays. Freight vehicle flow is significantly lower, averaging 17 FV/day.

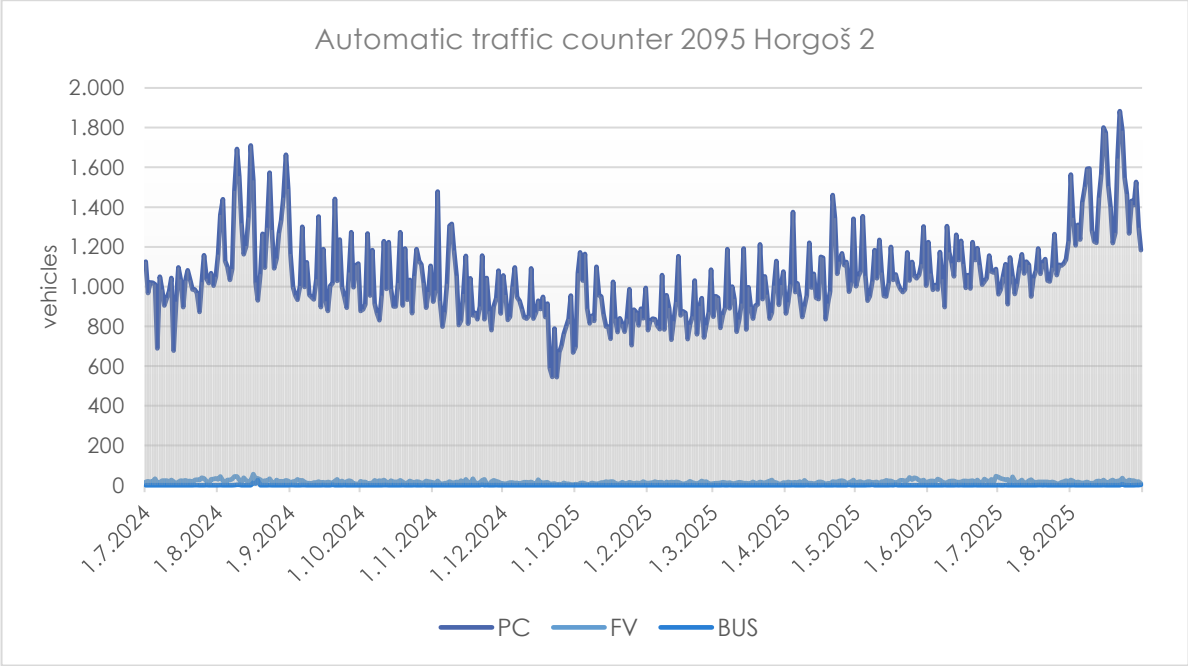


Figure 4-11 Distribution of vehicle flow nad category by day at the location of the automatic traffic counter 2095 Horgoš 2

#### Traffic analysis during reference periods (ATC 2095)

During the reference periods, vehicle flow was generally stable, averaging 1,062 vehicles/day. More significant variations were observed only in the period from August 23 to 24, when the recorded flow reached 1,825 and 1,568 vehicles/day, respectively (Figure 4-12).

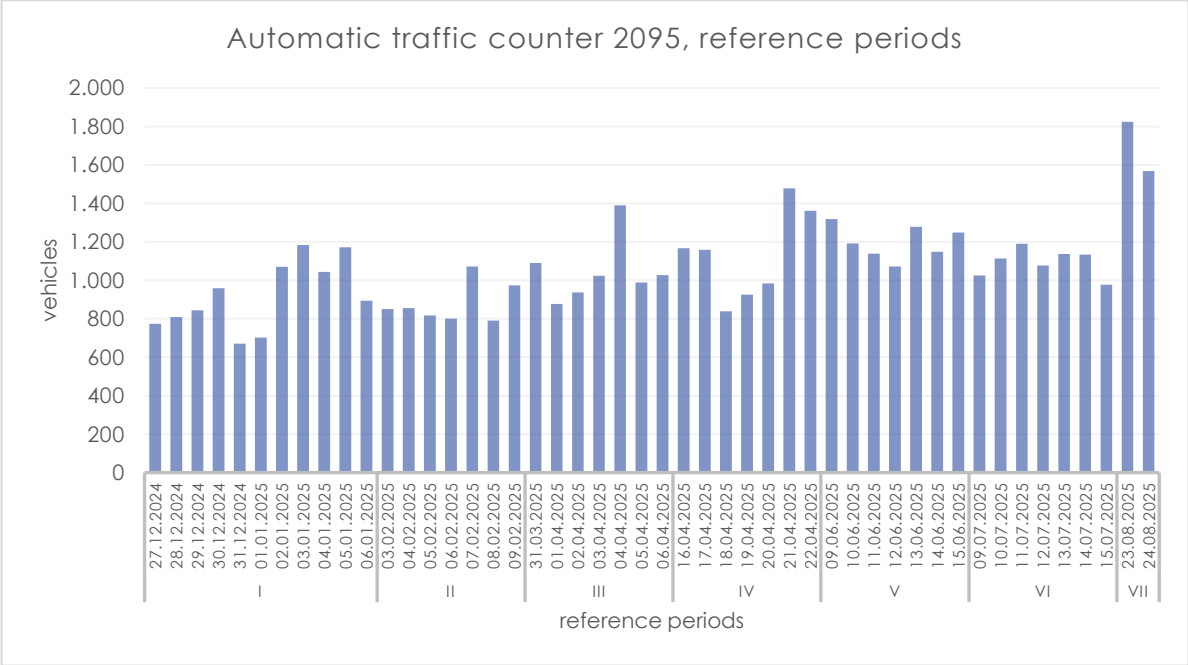


Figure 4-12 Distribution of vehicle flow by day at the location of the automatic traffic counter 2095 Horgoš 2, reference periods

Passenger cars dominate the overall traffic composition during the reference periods, accounting for between 97.13% and 99.72% of total flow. Freight vehicles accounted for 0.28%-2.87%, while buses ranged from 0.00% to 0.27% (Figure 4-13).

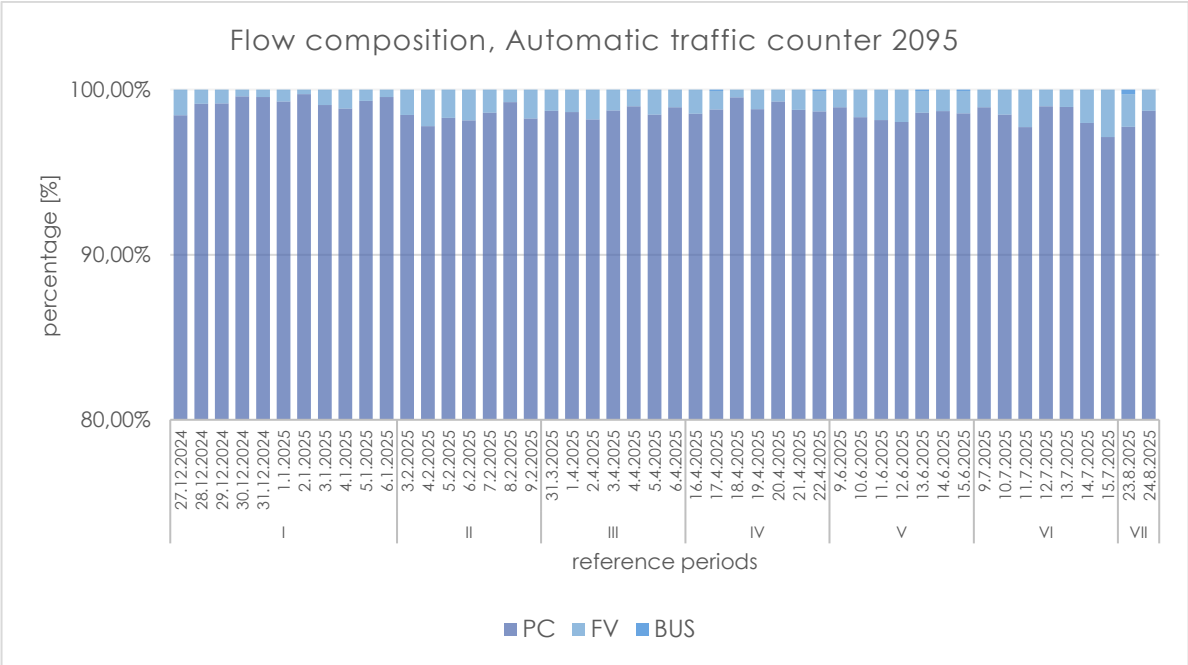


Figure 4-13 Daily traffic composition at the location of the automatic traffic counter 2095 Horgoš 2, reference periods

### 4.2.3. Automatic Traffic Counter 2085 Đala

Automatic traffic counter 2085 (Đala) is installed on state road IIA, route 103, at the road segment 10301, approximately 0.4 km from the Đala border crossing. The counter records the data on vehicle flow and composition in two directions:

- Direction 1: Novi Kneževac – border crossing,
- Direction 2: border crossing – Novi Kneževac.

All vehicles exiting the country through the Đala border crossing are recorded by this counter. Therefore, the analysis below focuses on the data for direction 1: Novi Kneževac – border crossing.

During the observed period, passenger car flow ranged from 174 to 1,097 PC/day, with an average of 458 PC/day. Mild flow variations were observed throughout the year, with weekend traffic being on average 63.4% higher than weekday traffic. The average passenger car flow was 634 PC/day during weekdays and 388 PC/day on weekdays. Freight vehicle flow was considerably lower, ranging from 0 to 51 FV/day, with an average of 2 FV/day. Buses were mostly absent throughout the observed period. (Figure 4-14).

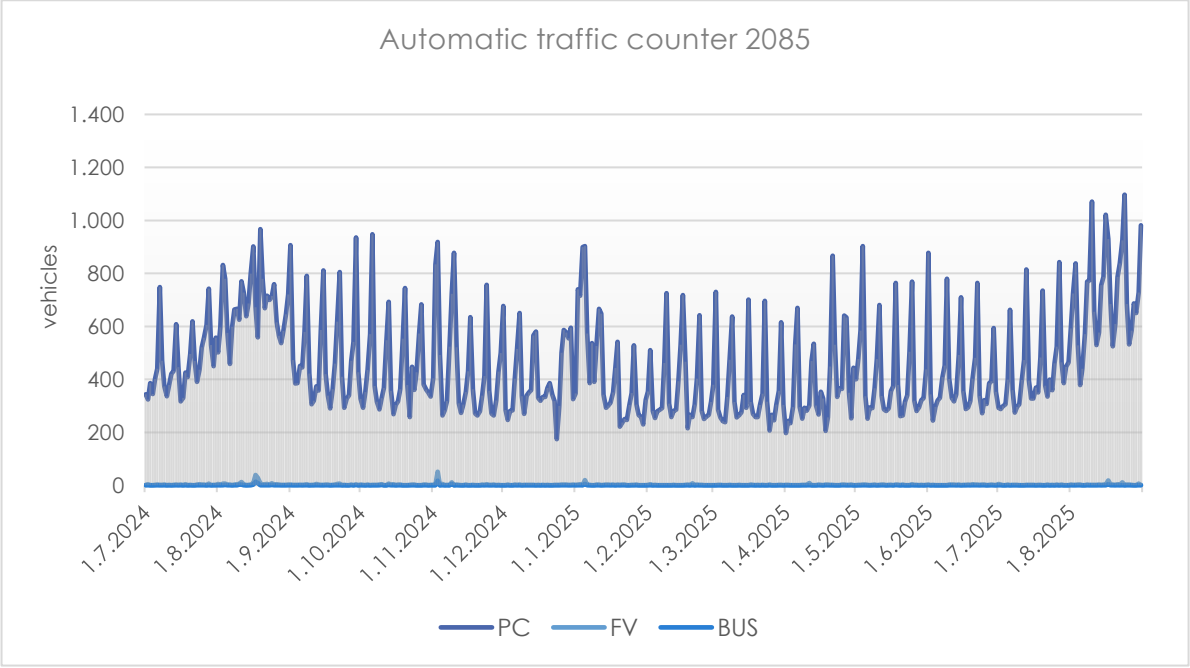


Figure 4-14 Distribution of vehicle flow and category by day at the location of the automatic traffic counter 2085 Đala

#### Traffic analysis during reference periods (ATC 2085)

Figure 4-15 shows the variations in daily vehicle flow at the location of automatic counter 2085 within the defined reference periods. During the analyzed period, traffic flow ranged from 198 to 1,097 vehicles/day, with an average of 486 vehicles/day. The highest values were recorded at the beginning of the year, during the summer season, and on weekends.

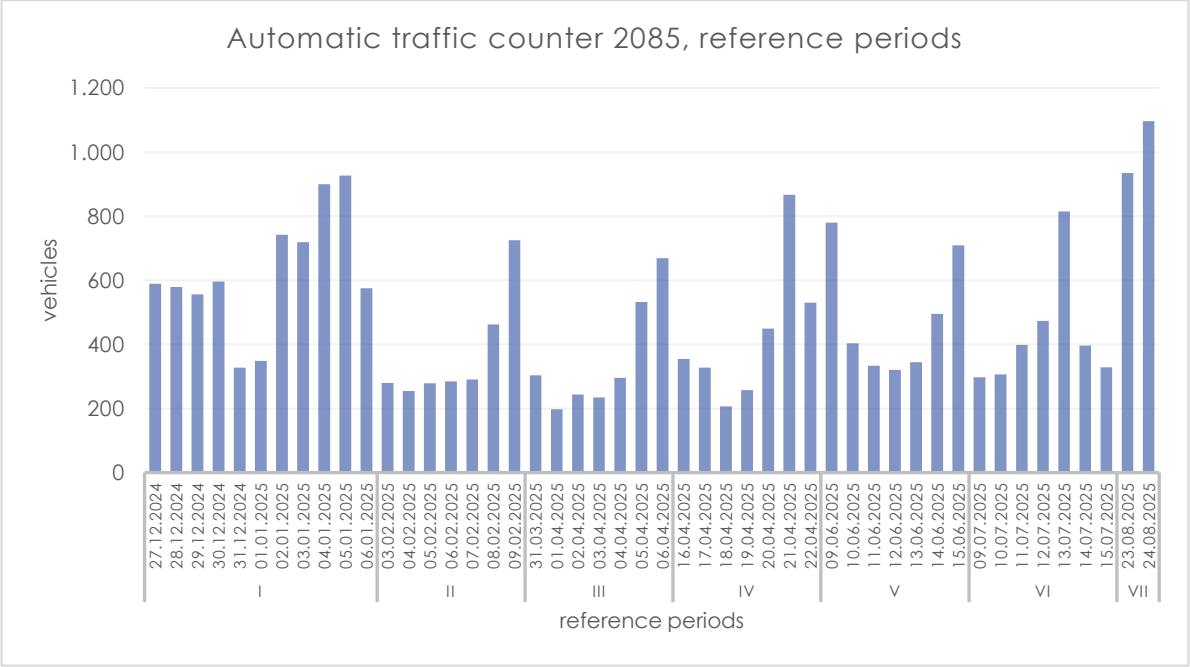


Figure 4-15 Distribution of vehicle flow by day at the location of the automatic traffic counter 2085 Đala, reference periods

Passenger cars dominate the total flow structure during the reference periods, accounting for 97.41% to 100% of the flow. Freight vehicle share ranged from 0.00% to 2.05%, while buses accounted for 0.00% to 0.54% (Figure 4-16).

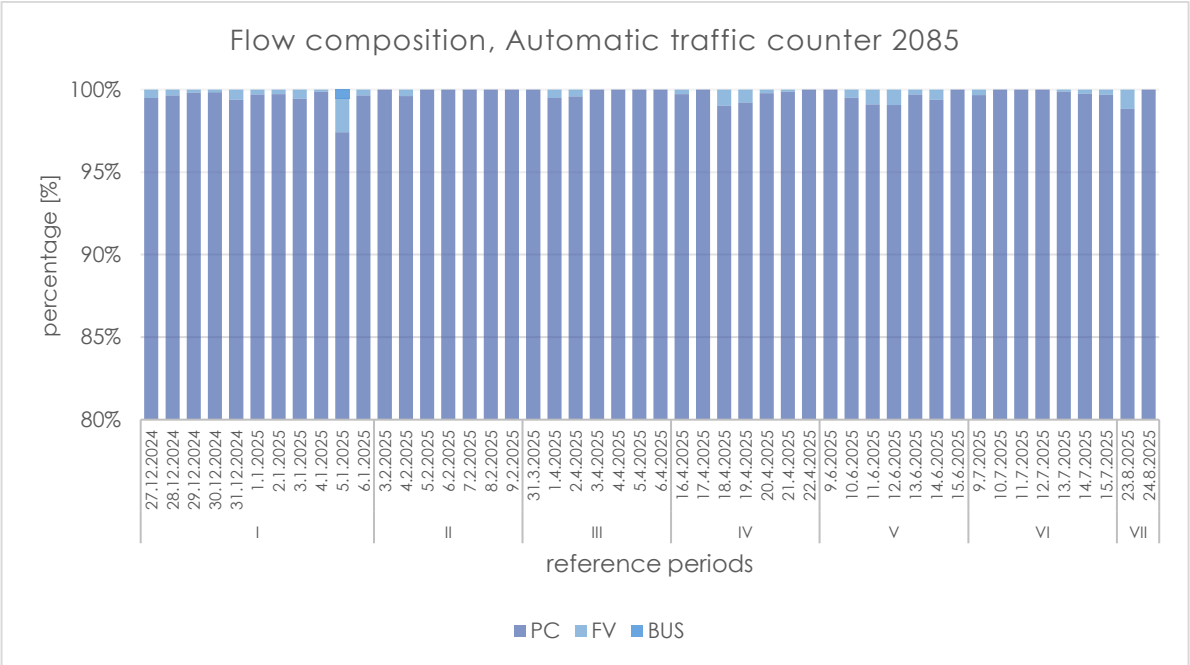


Figure 4-16 Daily traffic composition at the location of the automatic traffic counter 2085 Đala, reference periods

## 4.3. Data Processing from Border Crossings

Within the study, the flow of passengers and vehicles was analyzed at nine border crossings between the Republic of Serbia and the Republic of Hungary (Figure 4-17). From west to east, the following border crossings were included in the analysis:

- Bački Breg,
- Rastina,
- Bajmok,
- Kelebija,
- Bački Vinogradi,
- Horgoš,
- Horgoš 2,
- Đala и
- Rabe.

The analysis was carried out for each border crossing individually and covered only outbound traffic (vehicles and passenger exiting the Republic of Serbia). The analyzed period extended from July 1, 2024, to July 31, 2025, with particular focus on the previously defined reference periods.

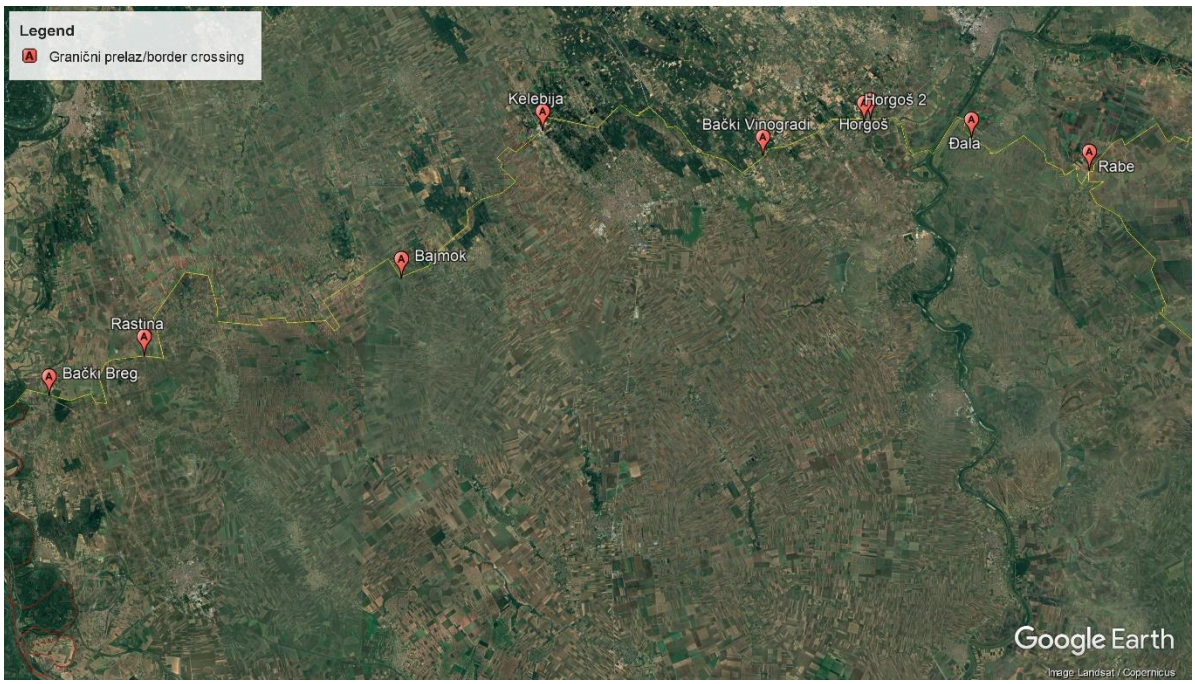


Figure 4-17 Border crossing locations
*Source: Google Earth, https://earth.google.com/web; accessed on Septembar 24, 2025.*

### 4.3.1. Border Crossing Bački Breg

The average monthly number of passengers who exited the Republic of Serbia through the Bački Breg border crossing during the analyzed period amounted to 28,561.

The highest deviation was recorded in August 2024, when 96,564 passengers left the country via this crossing – 3.4 times higher than the average (Figure 4-18). A quarter of all passengers who exited Serbia during the analyzed period were registered in August alone, indicating a pronounced seasonal load at this border crossing during the summer months.

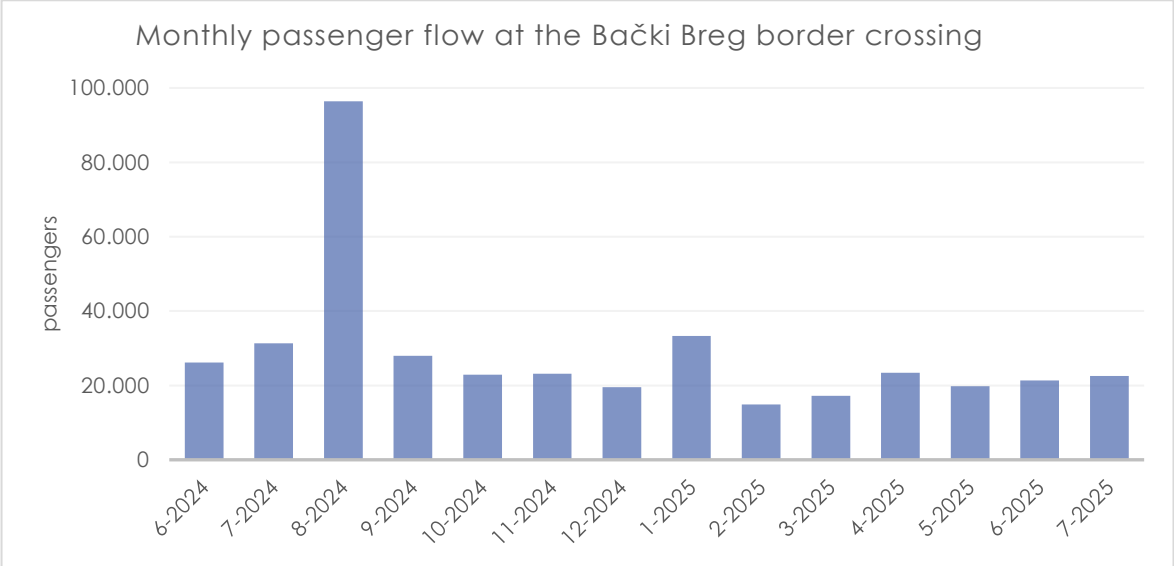


Figure 4-18 Monthly passenger flow distribution at the Bački Breg border crossing

Passenger cars dominate the overall composition, with an average value of 6,939 vehicles per month. Significant variation were recorded in August 2024, when the number of passenger cars reached 23,546. Freight vehicles maintained a stable and considerably lower intensity, averaging 2,640 vehicles per month, while the number of buses averaged 128 per month.

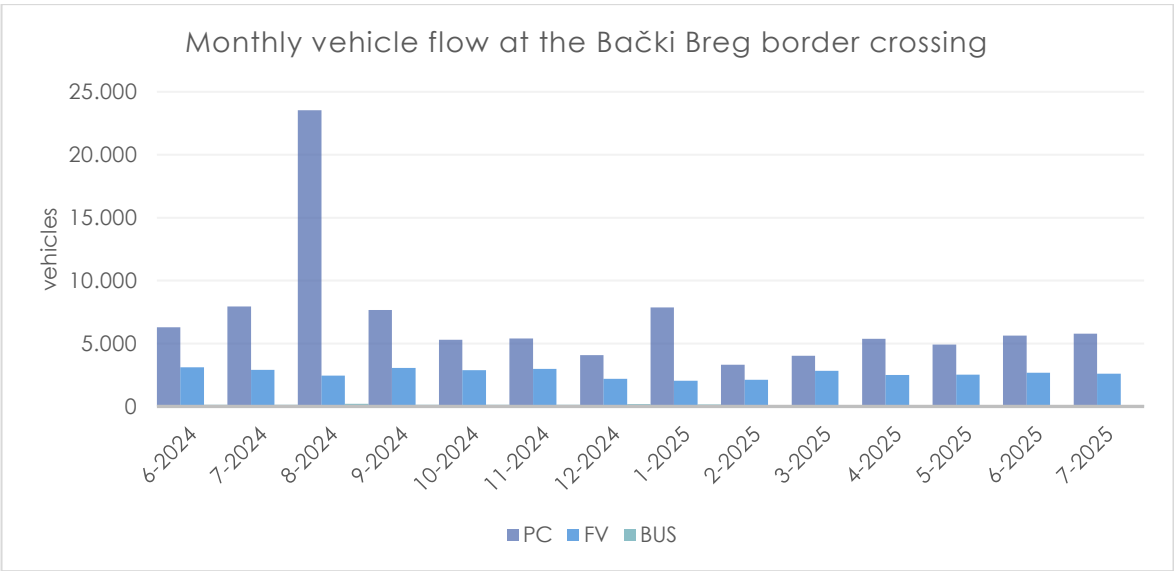


Figure 4-19 Monthly vehicle flow distribution by category at the Bački Breg border crossing

## Border crossing Bački Breg – reference periods

The highest passenger flows during the defined reference periods were recorded in two intervals: from January 3 to 5 (an average of 3,582 passengers/day) and from August 23 to 24 (an average of 4,850 passengers/day). On other days within the reference periods, the number of passengers was significantly lower, averaging 1,136 passengers/day (Figure 4-21, Figure 4-20).

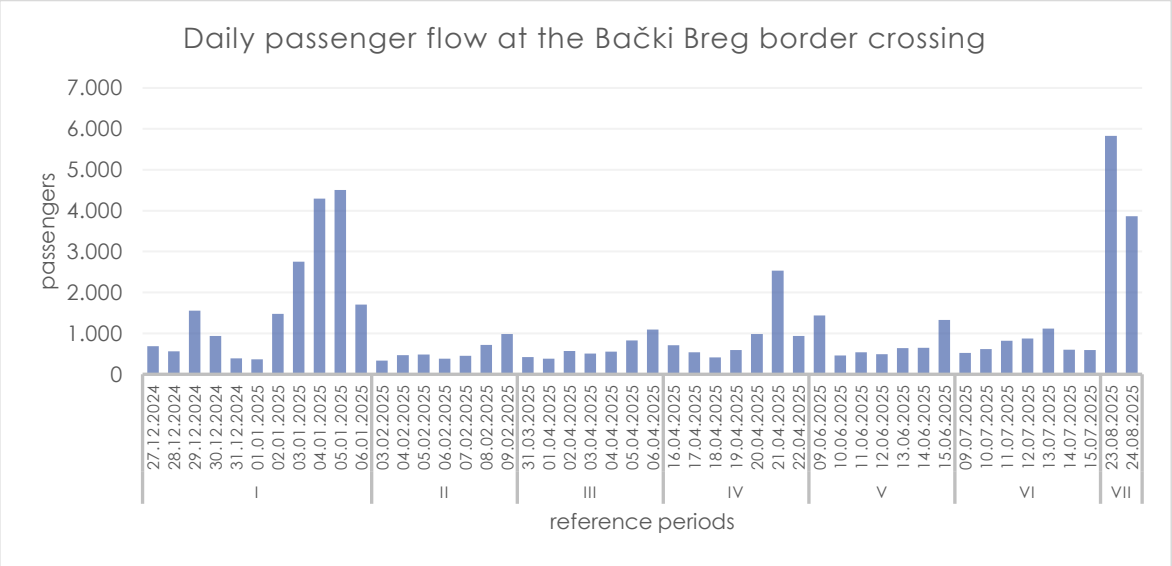


Figure 4-20 Daily passenger flow distribution at the Bački Breg border crossing, reference periods

Figure 4-21 shows the daily vehicle flow distribution by category within the defined reference periods. The average number of passenger cards exiting the Republic of Serbia amounted ro 270 vehicles per day. Pronounced variations in passenger car flow, similar to those observed in passenger numbers, were recorded in the periods January 3-5 and August 23-24, when flow values were up to five times higher than average (up to 1,340 vehiles/day). The average number of freight vehicles was 81 vehicles/day, while the maximum daily flow of 914 freight vehicles was recorded on February 6, 2025. Buses maintained a stable level of intensity, with an average value of 5 vehicles per day.

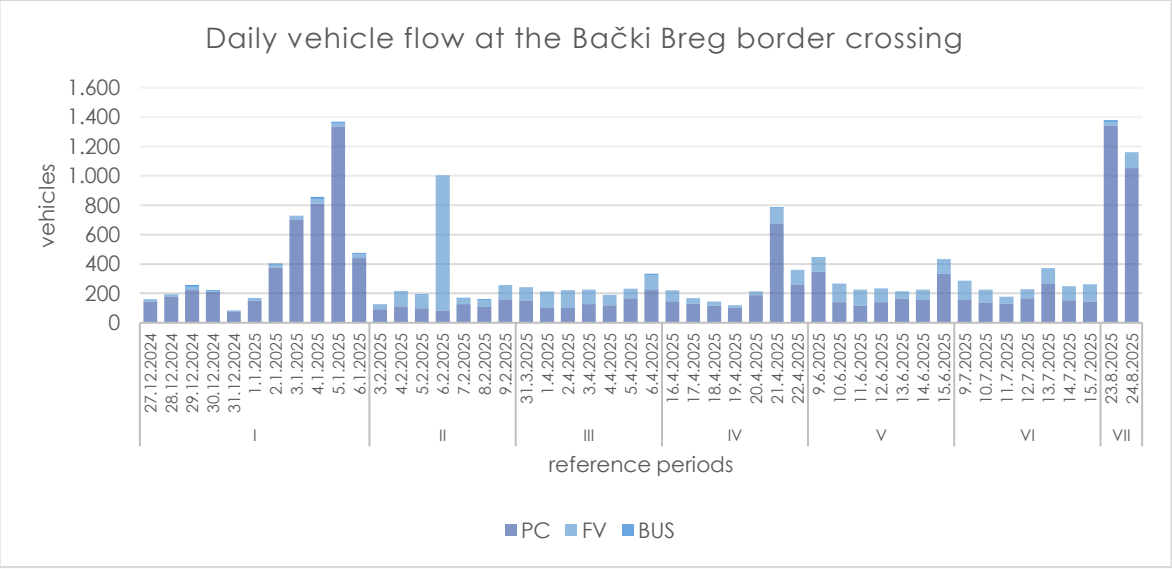


Figure 4-21 Distribution of vehicle flow and category by day at the Bački Breg border crossing, reference periods

## Border crossing Bački Breg – vehicle occupancy

The average occupancy of passenger vehicles at the Bački Breg border crossing during the observed period was 1.9 passengers/PC on weekdays and 2.1 passengers/PC on weekends.

Figure 4-22 shows the distribution of vehicles according to their occupancy. The largest share of vehicles at this crossing consists of vehicles with two passengers – 41% on weekdays and 42% on weekends. A significant share is also represented by vehicles with only the driver, 39% on weekdays and 29% on weekends.

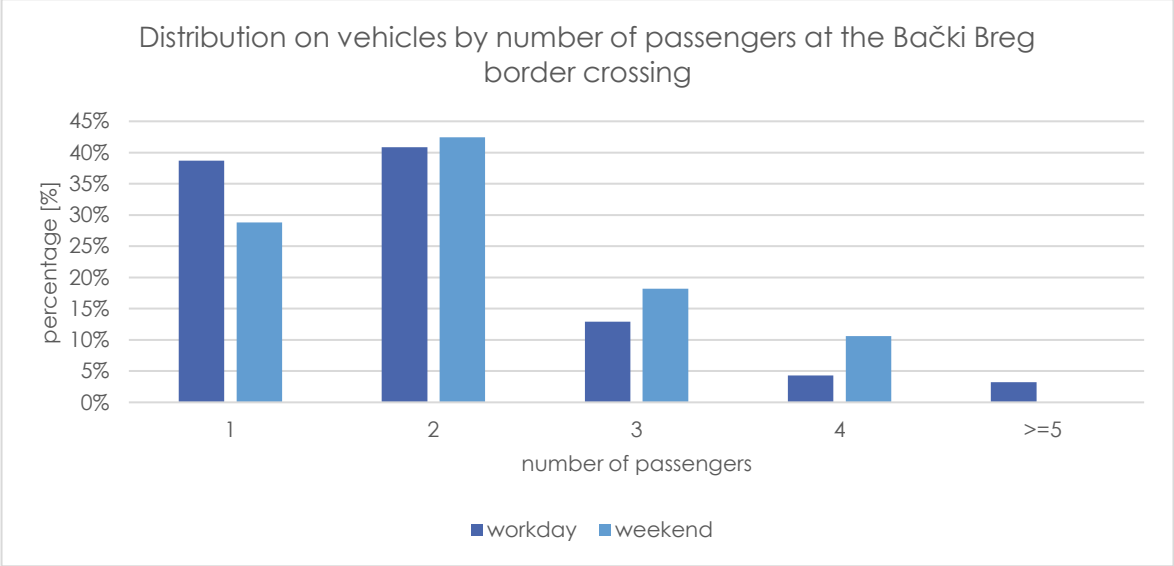


Figure 4-22 Distribution of vehicles by number of passengers at the Bački Breg border crossing

### 4.3.2. Border Crossing Rastina

Figure 4-23 shows the monthly passenger flow distribution at the Rastina border crossing. The average monthly number of passengers exiting the Republic of Serbia through this crossing during the analyzed period was 4,907. The highest deviation was recorded in August 2024, when 13,193 passengers left the country via Rastina, while the lowest passenger flow was registered in February 2025 (2,851 passengers).

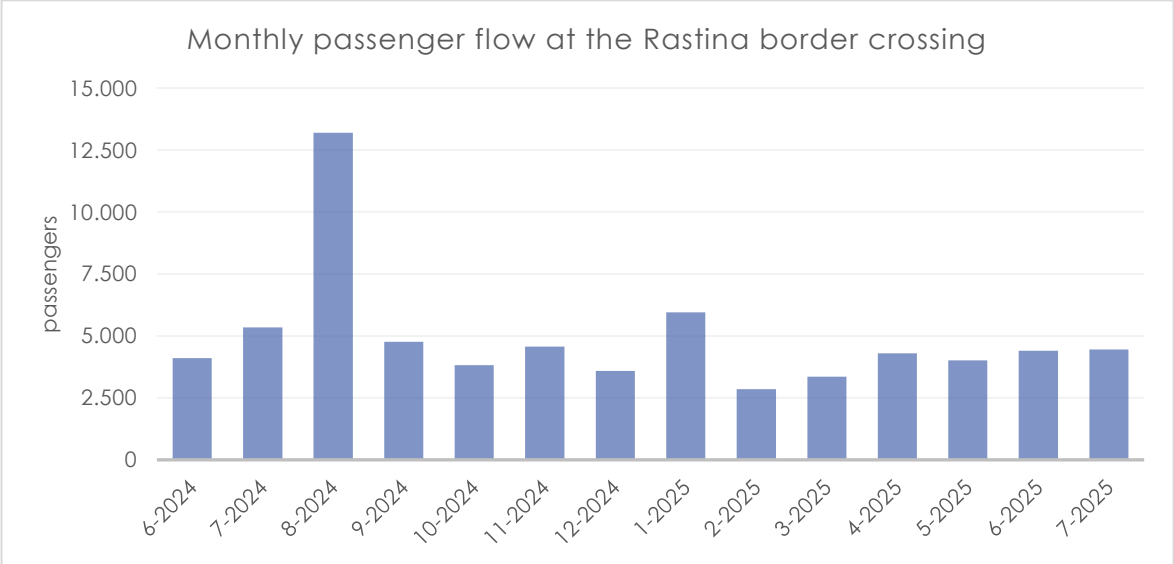


Figure 4-23 Monthly passenger flow distribution at the Rastina border crossing

Regarding the vehicle structure, only passenger cars were recorded at this crossing. The average monthly number of passenger cars amounted to 1,712 PC, with the highest value observed in August 2024 – 4,223 PC (Figure 4-24). During August, 17.6% of all passenger car movements recorded in the analyzed period occurred. The average vehicle occupancy throughout the analyzed period was 2.82 passengers per passenger car.

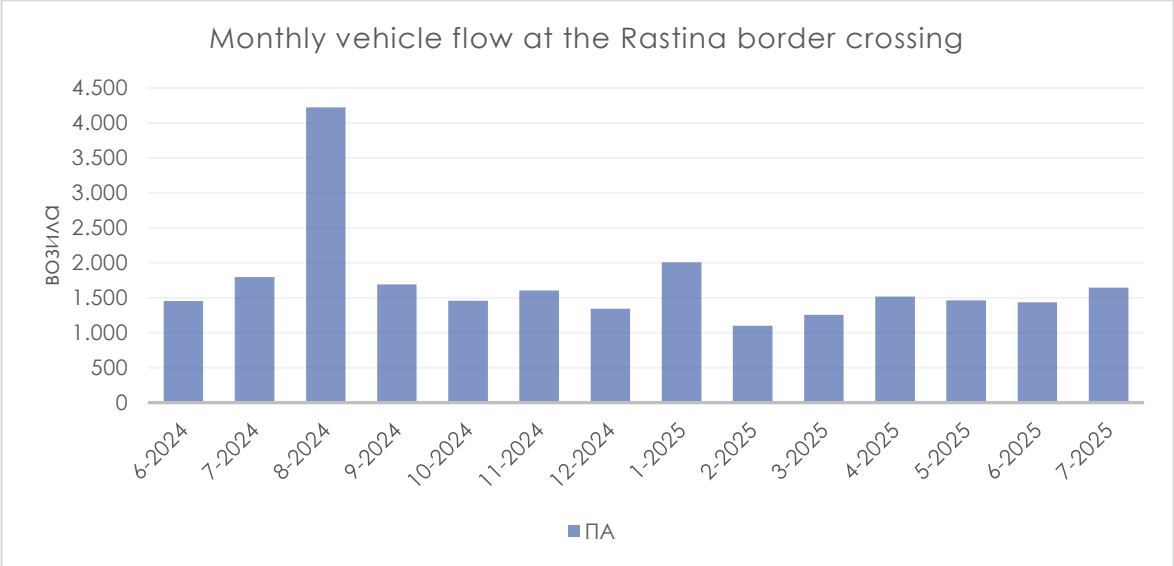


Figure 4-24 Monthly vehicle flow distribution by category at the Rastina border crossing

## Border crossing Rastina – reference periods

The average daily number of passengers exiting the country during the defined reference periods was 218 passengers/day. The most significant deviations were observed from January 3-5, April 21, and August 23-24, when the number of passengers reached values up to 4.3 times higher than the average (up to 944 passengers/day). The lowest passenger flow was recorded on February 4, with 47 passengers (Figure 4 24).

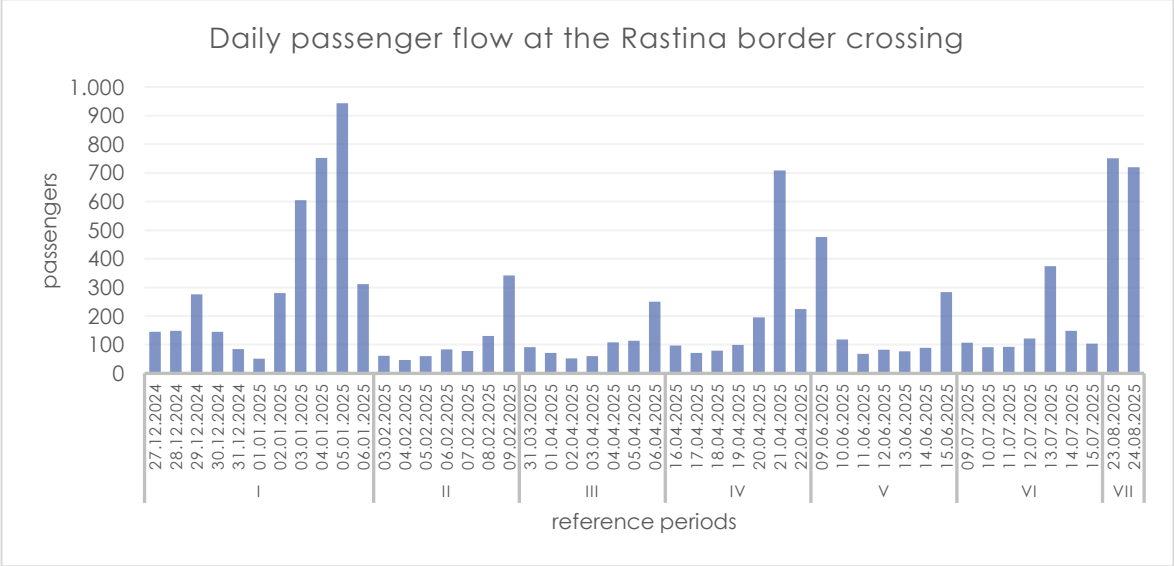


Figure 4-25 Daily passenger flow distribution at the Rastina border crossing, reference periods

The daily vehicle flow ranged from 15 to 264 PC/day, with an average of 73 PC/day (Figure 4-26). The average vehicle occupancy during the defined reference periods was 2.78 passengers per passenger car.

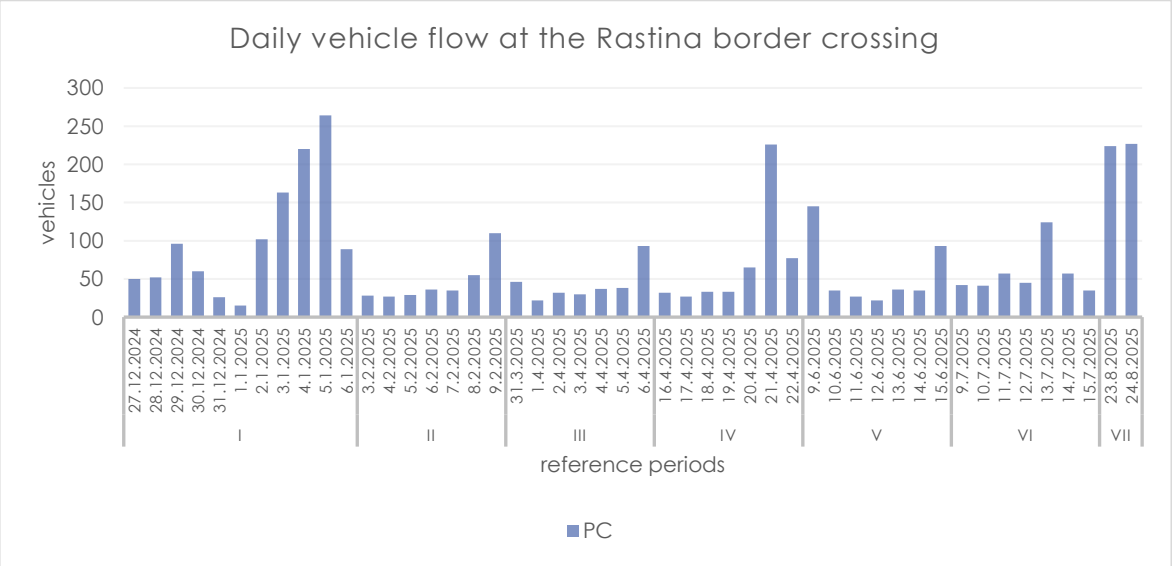


Figure 4-26 Distribution of vehicle flow and category by day at the Rastina border crossing, reference periods

## Border crossing Rastina – vehicle occupancy

Figure 4-27 shows he distribution of vehicles by number of passengers at the Rastina border crossing. The average vehicle occupancy during the observed period was 2.4 passengers/PC on weekdays and 2.3 passengers/PC on weekends. It can also be observed that on weekends, the largest share consists of vehicles with two and three passengers – 47% and 27% respectively. In contrast, on weekdays, behicles with one and two passengers dominate – 32% and 39%, respectively.

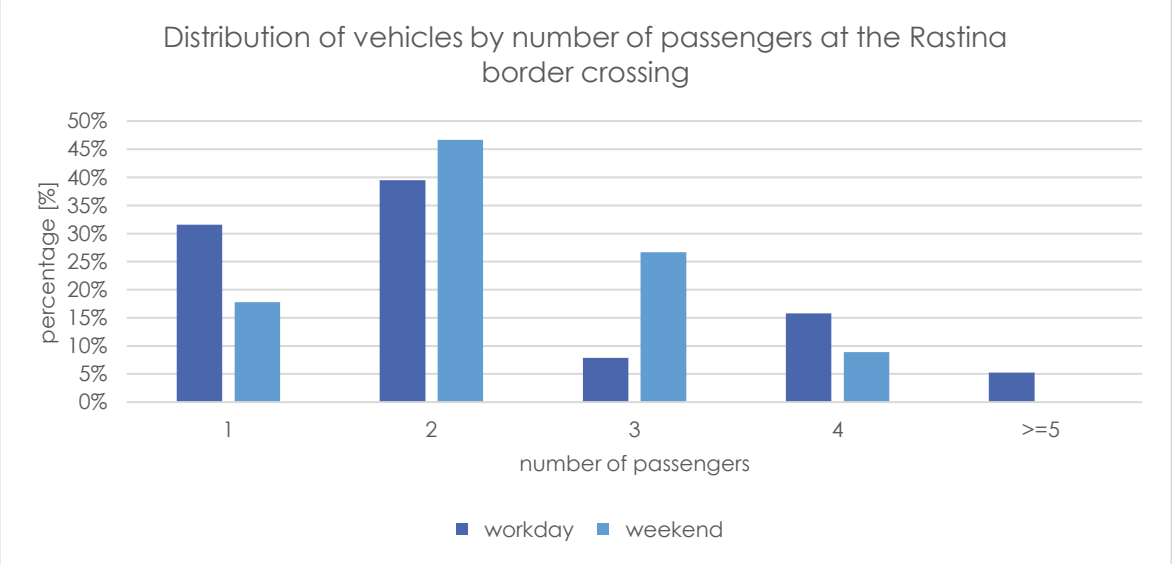


Figure 4-27 Distribution of vehicles by number of passengers at the Rastina border crossing

### 4.3.3. Border Crossing Bajmok

The average monthly number of passengers exiting the Republic of Serbia through the Bajmok border crossing during the observed period was 17,409. In August 2024, an exceptionally high passenger flow was recorded — about 3.1 times higher than the average, reaching 53,525 passengers (Figure 4-28). In other words, approximately 22% of all passengers who exited the country during the analyzed period did so through this crossing in August alone.

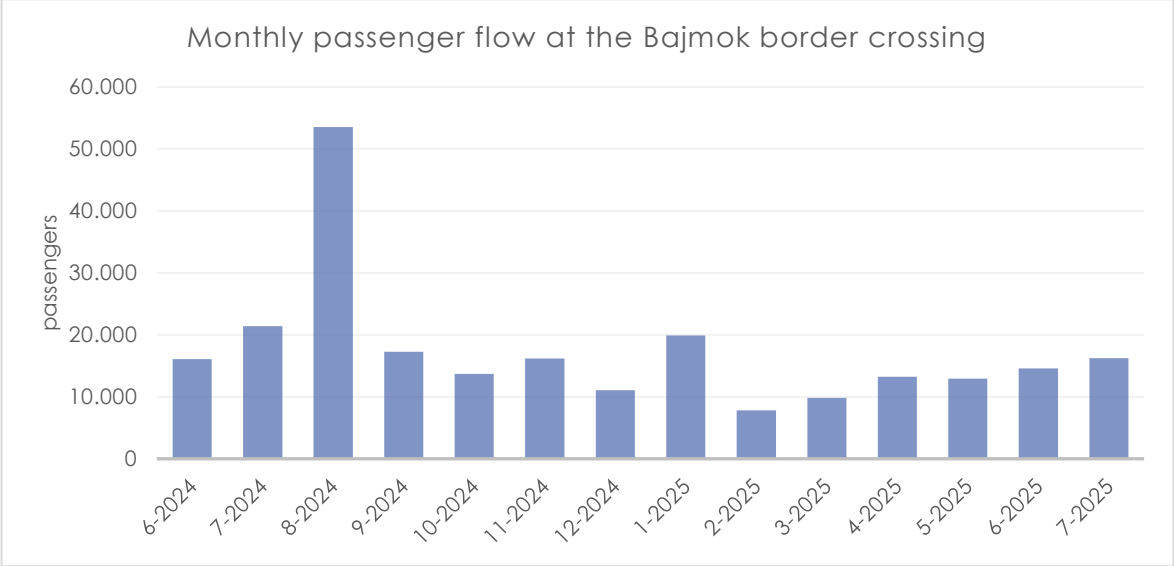


Figure 4-28 Monthly passenger flow distribution at the Bajmok border crossing

At this border crossing, only passenger cars were recorded, with no freight vehicles or buses observed. The monthly passenger car flow ranged from 2,633 (February 2025) to 18,100 PC (August 2025), with an average of 5,794 PC/month (Figure 4-11). The average vehicle occupancy during the observed period was 3.03 passengers per passenger car.

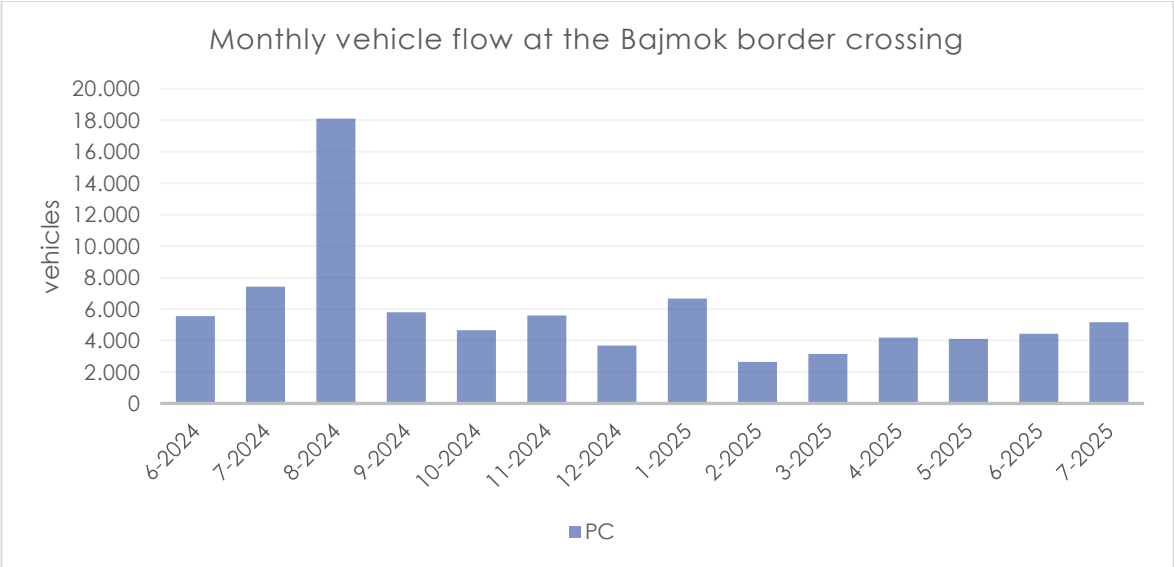


Figure 4-29 Monthly vehicle flow distribution by category at the Bajmok border crossing

## Border crossing Bajmok – reference periods

The daily number of passengers exiting the country during the defined reference periods ranged 132 to 3,382 passengers/day, with an average of 757 passengers/day. The highest daily flows were recorded during seasonal periods — namely, from January 3 to 6 and from August 23 to 24 (Figure 4-30). Out of a total of 36,314 passengers recorded within the defined reference periods, 17,314 passengers (approximately 47.7%) crossed the border during just the six busiest days.

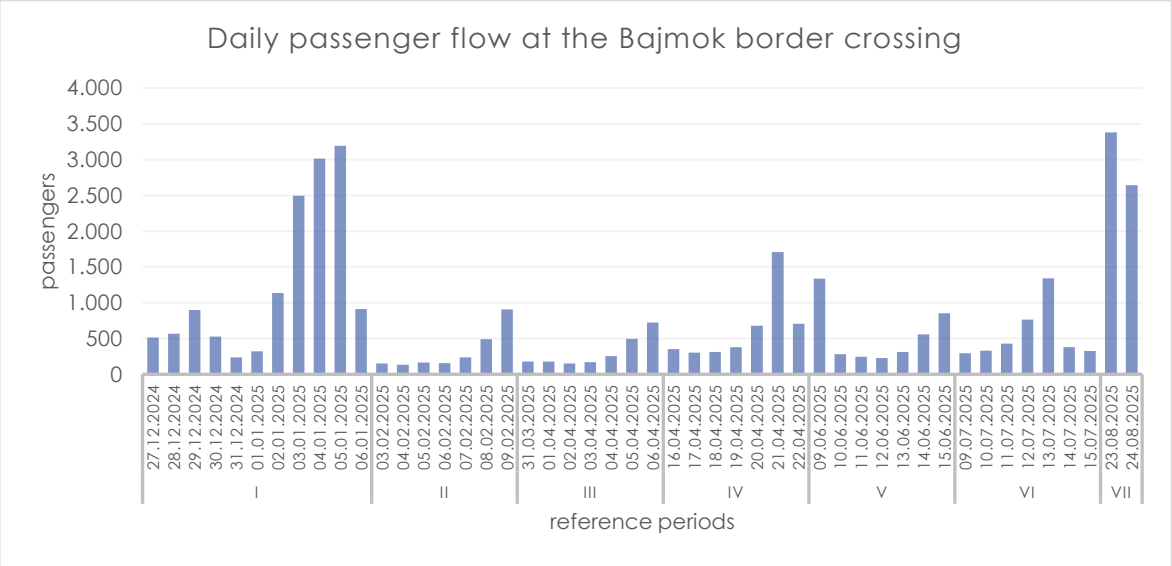


Figure 4-30 Daily passenger flow distribution at the Bajmok border crossing, reference periods

The average daily number of passenger cars exiting the Republic of Serbia at the Bajmok border crossing was 259 PC (Figure 4-31), while the average vehicle occupancy was 3.05 passengers per passenger car. The highest vehicle flows were recorded during the same time intervals as the highest passenger flow — from January 3 to 5 and from August 23 to 24. The maximum daily passenger car flow was recorded on January 5, reaching 1,602 PC, which represents approximately 6.2 times the average daily value.

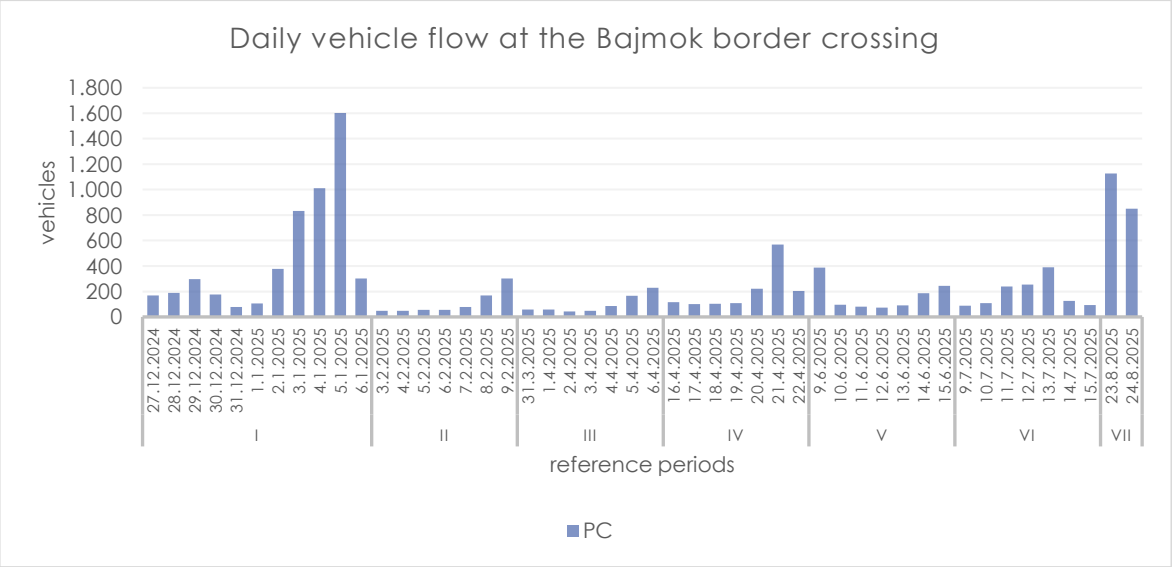


Figure 4-31 Distribution of vehicle flow and category by day at the Bajmok border crossing, reference periods

## Border crossing Bajmok – vehicle occupancy

At the Bajmok border crossing, vehicles with two passengers are the most common (Figure 4-32). On weekdays, 43% of all vehicles have two passengers, and on weekends 41%. Additionally, vehicles with only one passenger have a notable share on weekdays (41%). The average vehicle occupancy during the study period was 1.8 passengers per vehicle on weekdays and 2.4 passengers per vehicle on weekends.

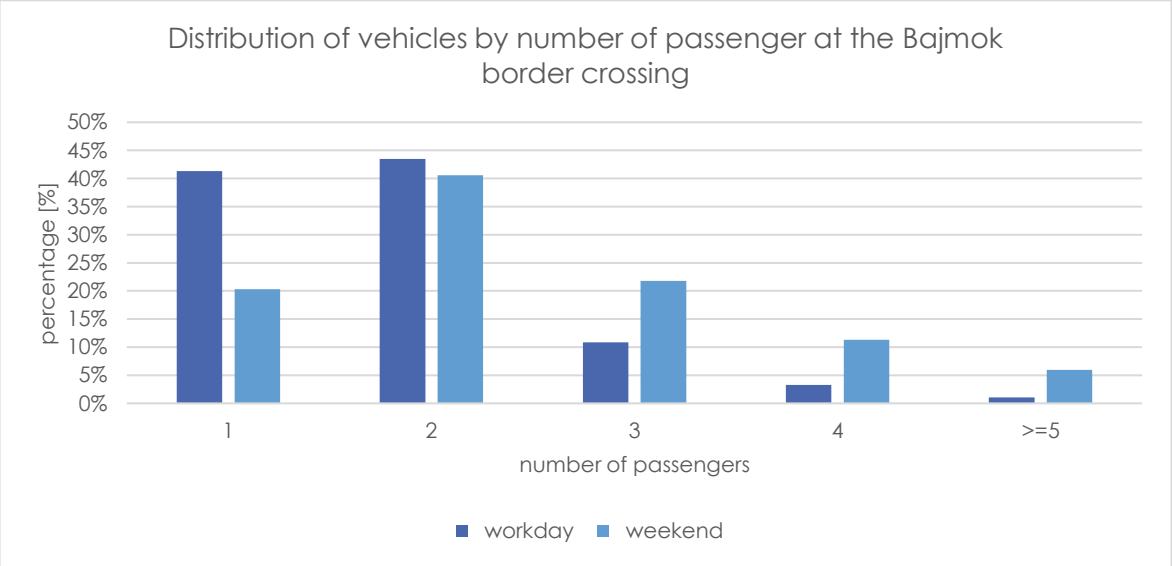


Figure 4-32 Distribution of vehicles by number of passengers на граничном прелазу Bajmok

### 4.3.4. Border Crossing Kelebija

The average monhtly number of passengers exiting the Republic of Serbia through the Kelebija border crossing during the observed period was 102,414 passengers. Significant variations in passenger flow were recorded — for instance, in March 2025, the flow amounted to 7,898 passengers, while in August 2024, it reached 242,775 passengers (Figure 4-33).

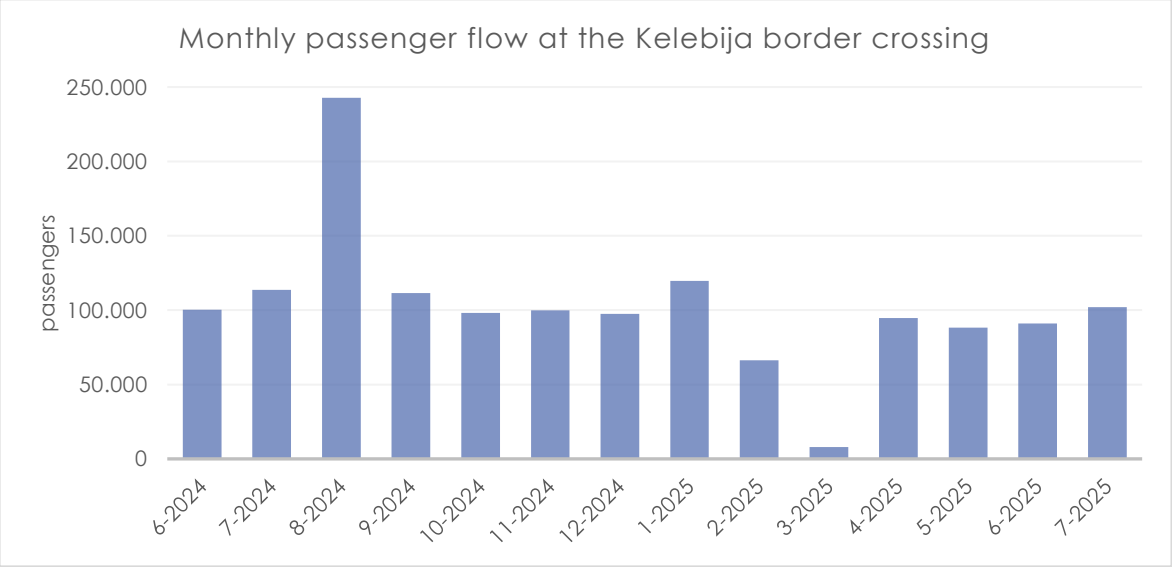


Figure 4-33 Monthly passenger flow distribution at the Kelebija border crossing

When it comes to the vehicle structure, passenger cars dominate the total flow, with an average of 23,858 PC/month. The highest monthly passenger car flow was recorded in August (54,495 PC), while the lowest was registered in February (14,433 PC). Freight vehicles maintained a stable but significantly lower intensity, averaging 11,970 HV/month, while buses ranged between 480 and 1,083, with an average of 728 BUS/month (Figure 4-34).

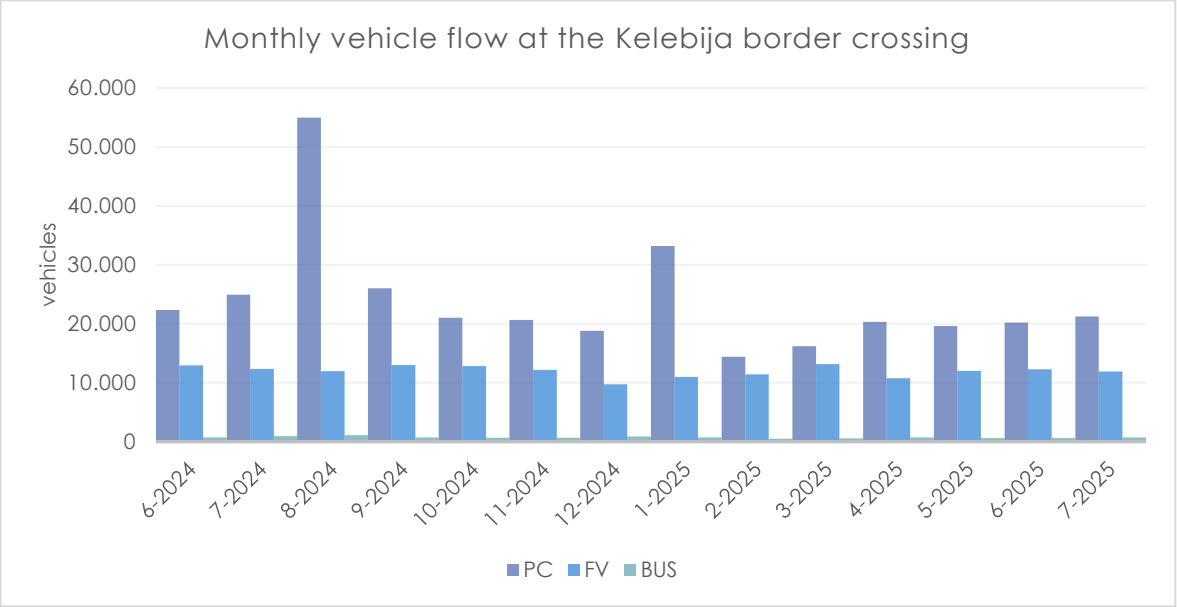


Figure 4-34 Monthly vehicle flow distribution by category at the Kelebija border crossing

## Border crossing Kelebija – reference periods

The average daily number of passangers exiting the country during the defined reference periods was 4,362 passengers/day. The highest daily flows were recorded during seasonal periods — on January 5 (17,018 passengers) and on August 23 and 24, with 17,129 and 14,107 passengers/day, respectively (Figure 4-35). On other days within the reference periods, passenger flows were significantly lower, with slight fluctuations during weekends.

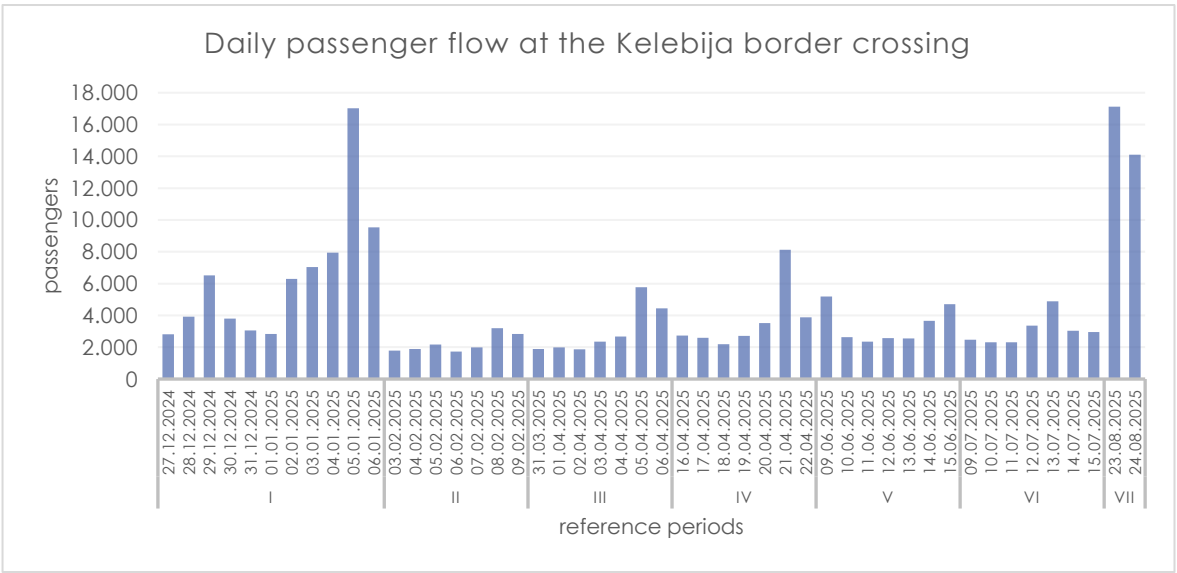


Figure 4-35 Daily passenger flow distribution at the Kelebija border crossing, reference periods

The average daily number of passenger cars recorded at the Kelebija border crossing was 1,134 PC/day. A significant deviation from the average value was observed on January 5, 2025, when the number of passenger cars reached 10,416 PC, which is about 9.2 times higher than the daily average. Freight vehicles and buses maintained a stable and much lower intensity, with the average values of 315 FV/day and 27 BUS/day (Figure 4-36).

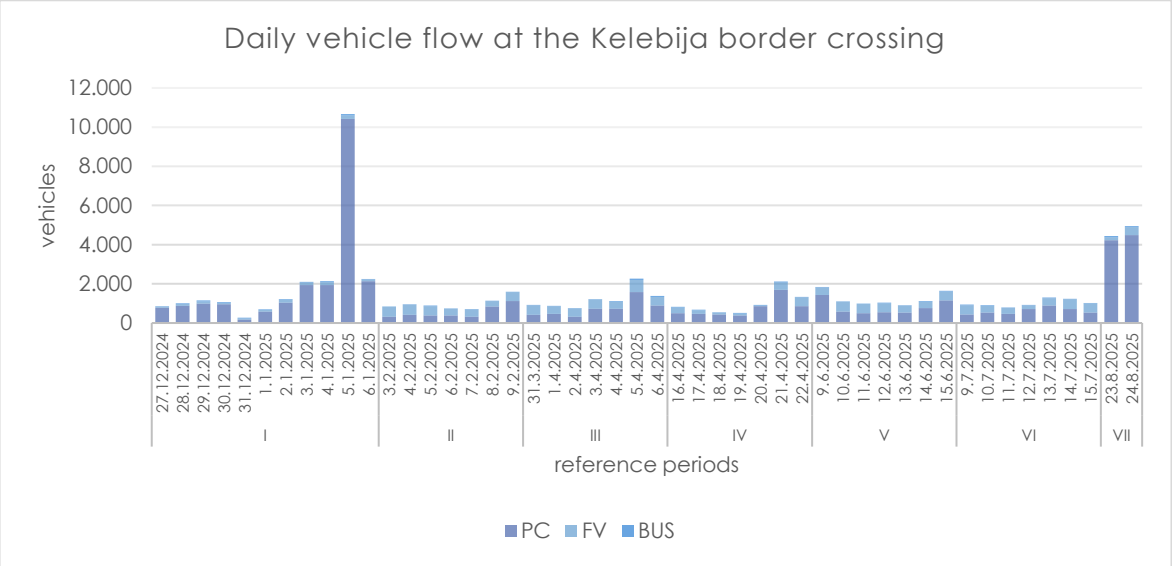


Figure 4-36 Distribution of vehicle flow and category by day at the Kelebija border crossing, reference periods

### Border crossing Kelebija – vehicle occupancy

Figure 4-37 shows the distribution of vehicles by number of passengers at the Kelebija border crossing. Results indicate that vehicles with two passengers account for the largest share on weekends (56%), while on weekdays, vehicles with only one passenger (driver only) dominate – 44%. The average vehicle occupancy during the observed period was 1.8 passengers/PC on weekdays and 2.1 passengers/PC on weekends.

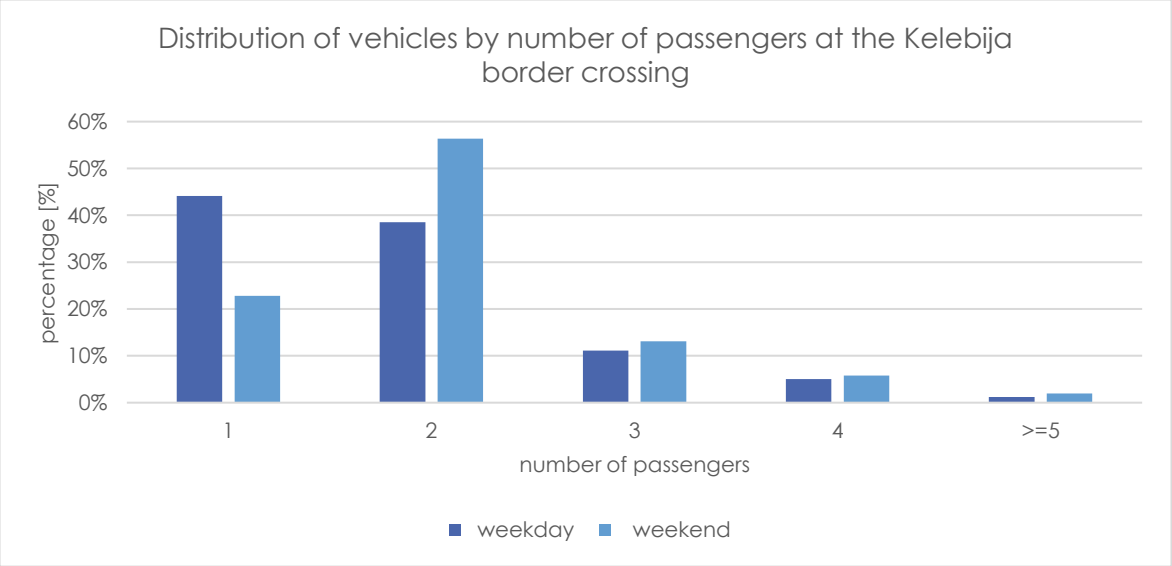


Figure 4-37 Distribution of vehicles by number of passengers at the Kelebija border crossing

## 4.3.5. Border Crossing Bački Vinogradi

Figure 4-38 shows the monthly distribution of passengers exiting the Republic of Serbia through the Bački Vinogradi border crossing. During the observer period, the number of passengers ranged from 23,256 (March 2025) to 45,964 (August 2024), with an average of 29,425 passengers/month.

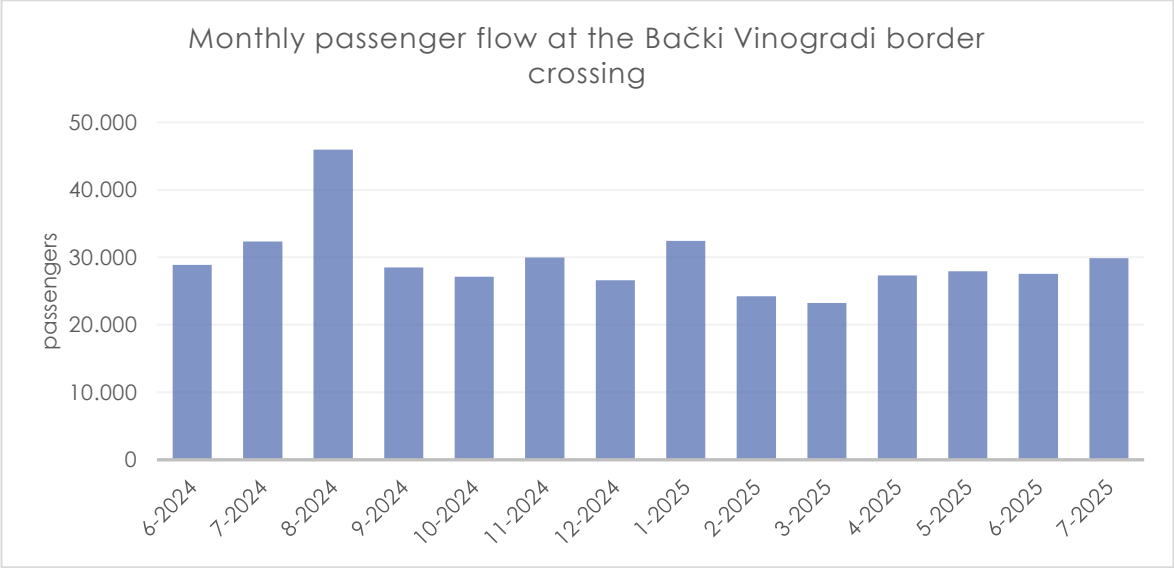


Figure 4-38 Monthly passenger flow distribution at the Bački Vinogradi border crossing

Only passenger cars were recorded at this border crossing, while freight vehicles and buses were not registered. On average, 9,827 passenger cars/month exited the Republic of Serbia throught this crossing, while the maximum monthly flow was recorded in August – 15,700 PC (Figure 4-39). The average vehicle occupancy during the analyzed period was 3.00 passengers/PC.

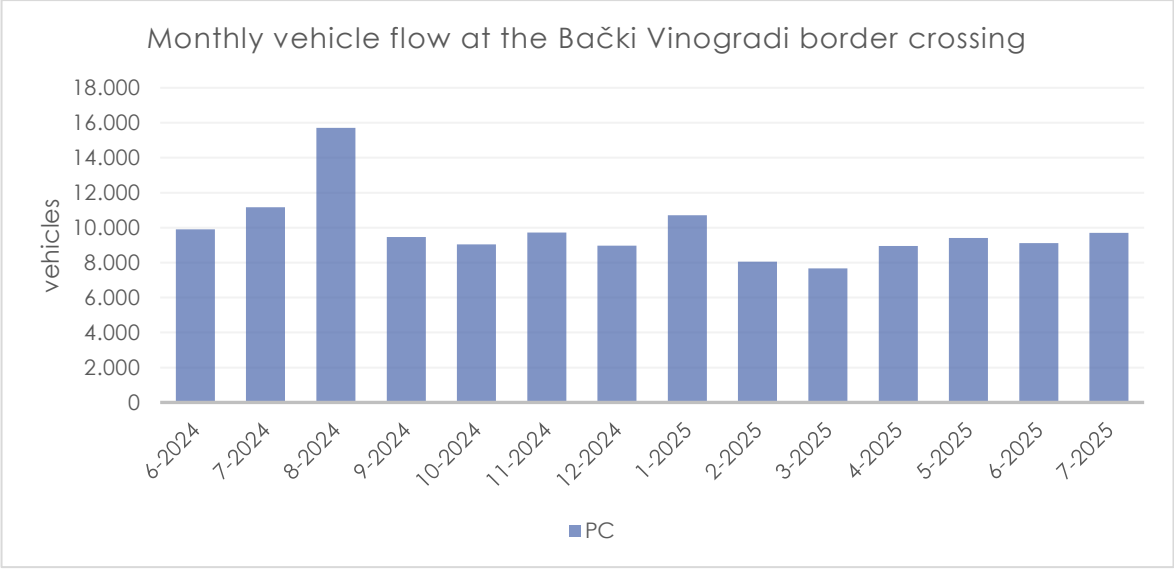


Figure 4-39 Monthly vehicle flow distribution by category at the Bački Vinogradi border crossing

## Border crossing Bački Vinogradi – reference periods

The daily number of passengers exiting the country through this border crossing during the defined reference periods ranged 416 to 2,441, with an average of 1,119 passengers/day (Figure 4-40). The highest daily flows were recorded during seasonal peaks and Easter holidays.

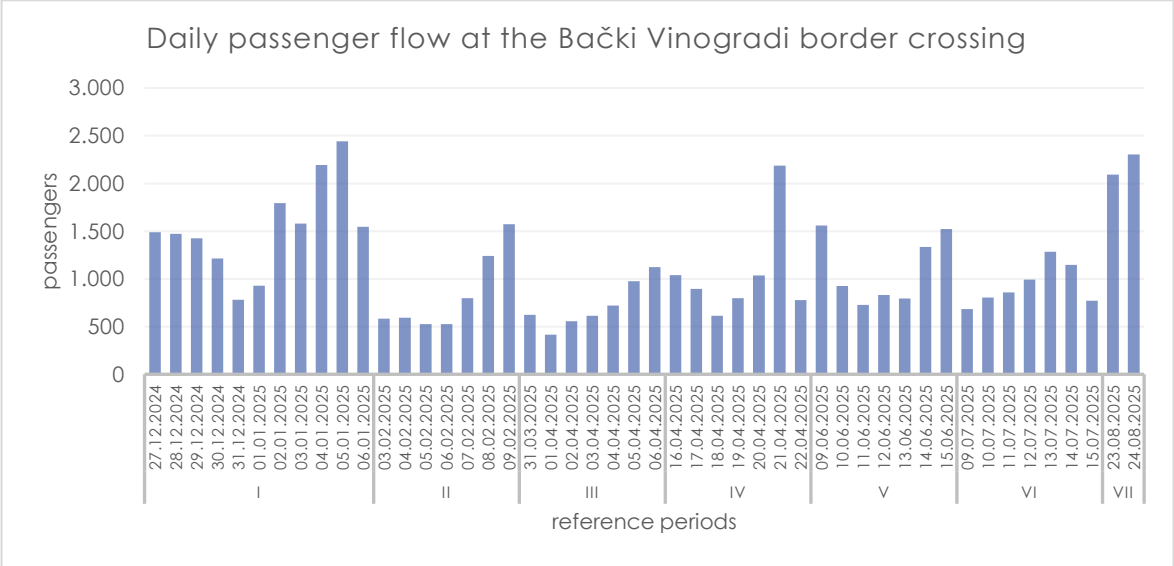


Figure 4-40 Daily passenger flow distribution at the Bački Vinogradi, reference periods

The daily vehicle flow ranged from 147 to 798 PC/day,with an average of 376 PC/day (Figure 4-41). The average vehicle occupancy during the defined reference periods was 3.00 passengers/PC.

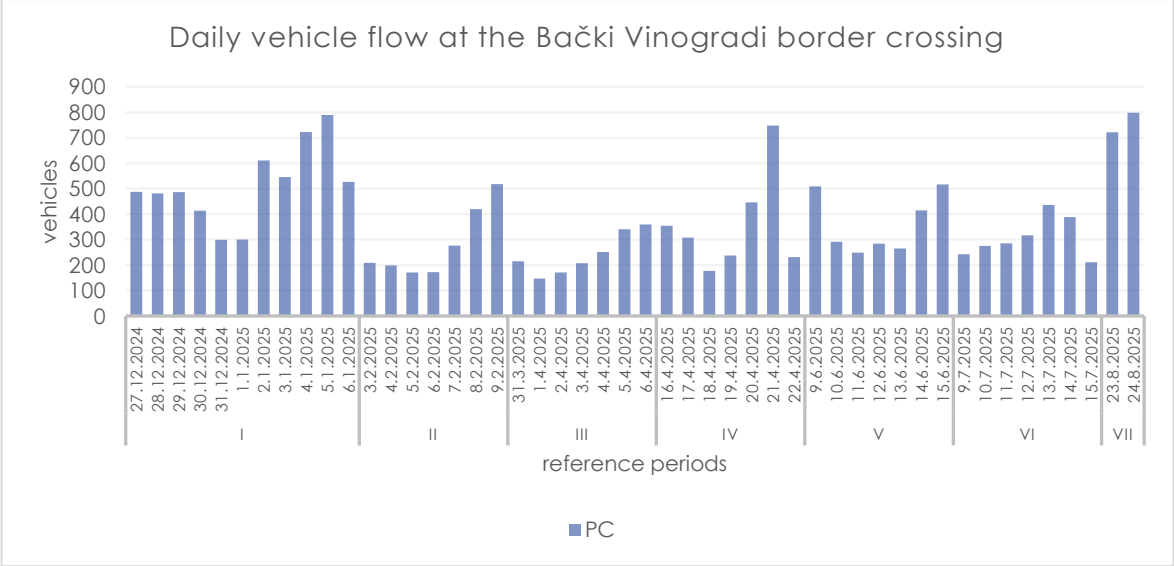


Figure 4-41 Distribution of vehicle flow and category by day at the Bački Vinogradi border crossing, reference periods

## Border crossing Bački Vinogradi – vehicle occupancy

The average occupancy of passenger vehicles at the Bački Vinogradi border crossing during the study period was 1.9 passengers/PC on weekdays and 2.1 passengers/PC on weekends.

Figure 4-42 shows the distribution of vehicles according to their occupancy. Vehicles with one or two passengers represent the largerst share, totaling 86% on weekdays and 75% on weekends. In contrast, vehicles with five or more passengers make up the smallest share (3% on weekdays and 4% on weekends).

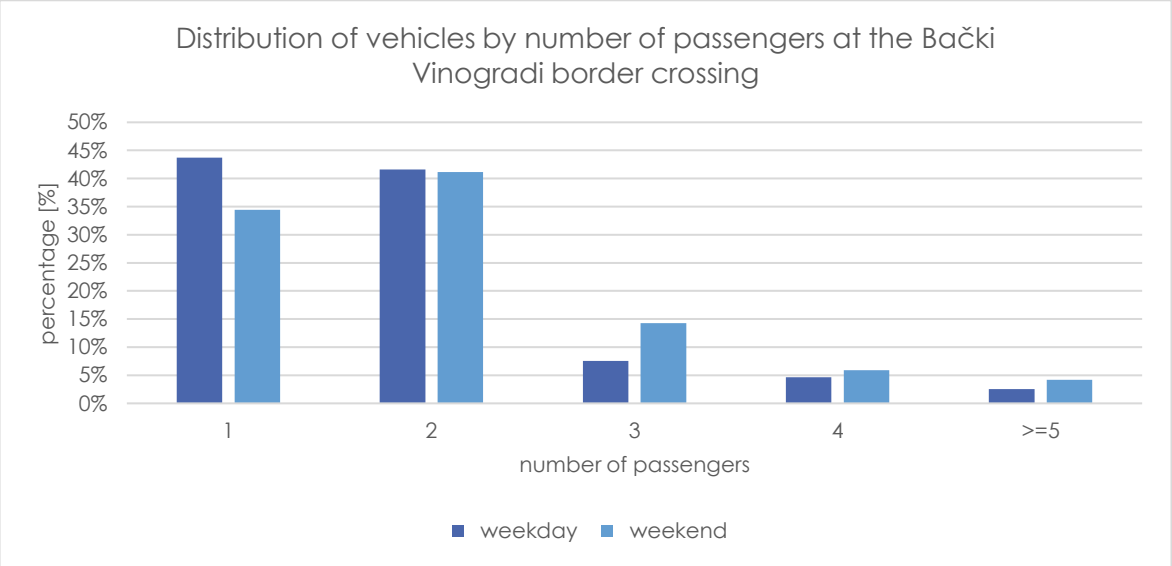


Figure 4-42 Distribution of vehicles by number of passengers at the Bački Vinogradi border crossing

### 4.3.6. Border Crossing Horgoš

The average monthly number of passengers exiting the Republic of Serbia through the Horgoš border crossing during the analyzed period amounted to 239,750. The highest flow was recorded in August 2024, when 608,948 passengers were registered (Figure 4-43), which is approximately 2.5 times higher than the average monthly value.

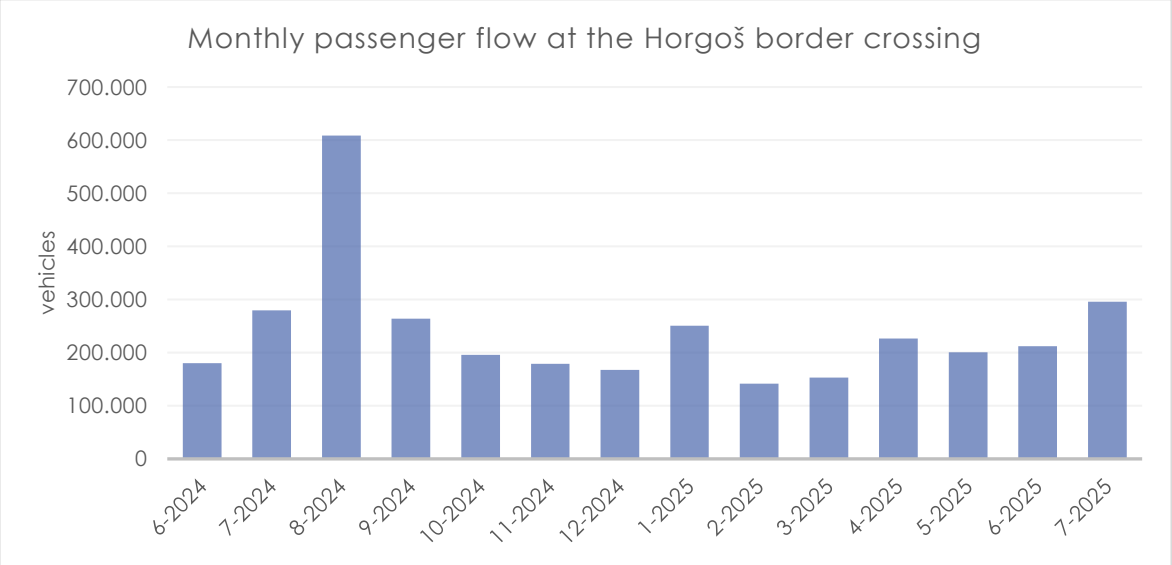


Figure 4-43 Monthly passenger flow distribution at the Horgoš border crossing

Figure 4-44 shows the monthly vehicle flow distribution by category. The average monthly number of passenger cars exiting Serbia was 56,699 PC. Pronounced variations were observed in August 2024, when 154,149 passenger cars were recorded. In other words, approximately 19.4% of all passenger cars registered during the analyzed period crossed the border at Horgoš in August alone. Freight vehicles and buses maintained a stable and significantly lower intensity, with average values of 15,579 FV/month and 1,719 BUS/month.

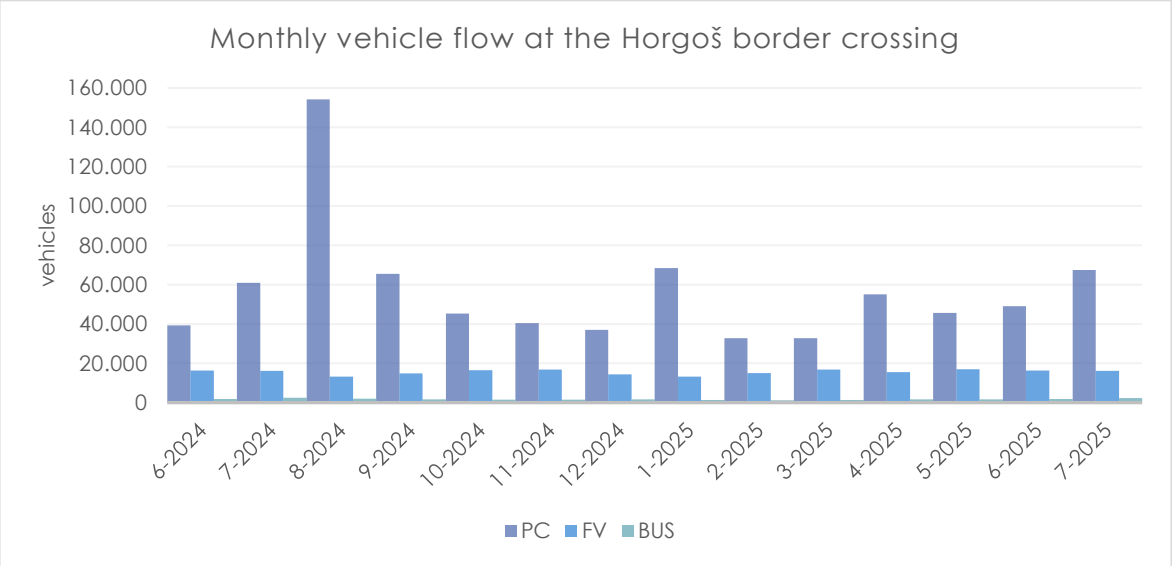


Figure 4-44 Monthly vehicle flow distribution by category at the Horgoš border crossing

## Border crossing Horgoš – reference periods

The average daily number of passengers exiting Serbia through the Horgoš border crossing during the reference periods was 9,421 passengers/day. The highest flows were recorded on August 23 and 24m with 29,956 and 39,054 passengers, respectively — approximately 3.2 and 4.1 times higher than the average daily value (Figure 4-45).

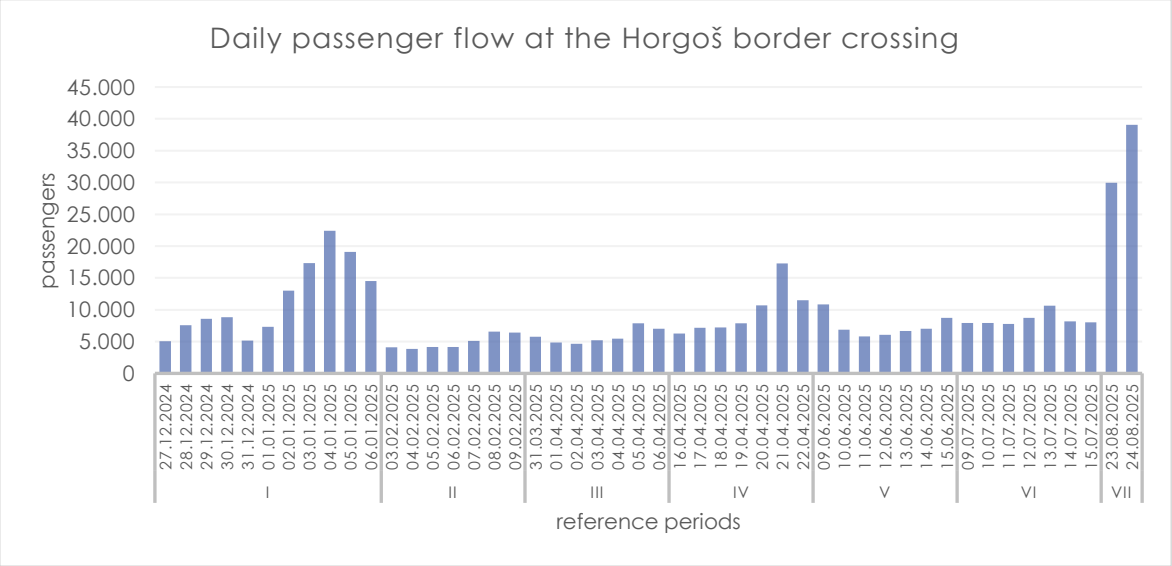


Figure 4-45 Daily passenger flow distribution at the Horgoš border crossing, reference periods

During the reference periods, the average number of passenger cars recorded at the Horgoš border crossing was 2,306 PC/day. The most significant deviations from the average were observed during the summer season, on August 23 and 24, 2025, when 7,196 and 7,294 PC were registered, respectively. A noticable increase was also recorded at the beginning of the year (January 2-6; average 5,010 PC/day) and around Easter holidays (April 20-22; average 3,630 PC/day). The number of freight vehicles ranged from 122 to 724 FV/day, with an average of 444 FV/day, while bus flow ranged from 23 to 144 BUS/day, with an average of 57 BUS (Figure 4-46).

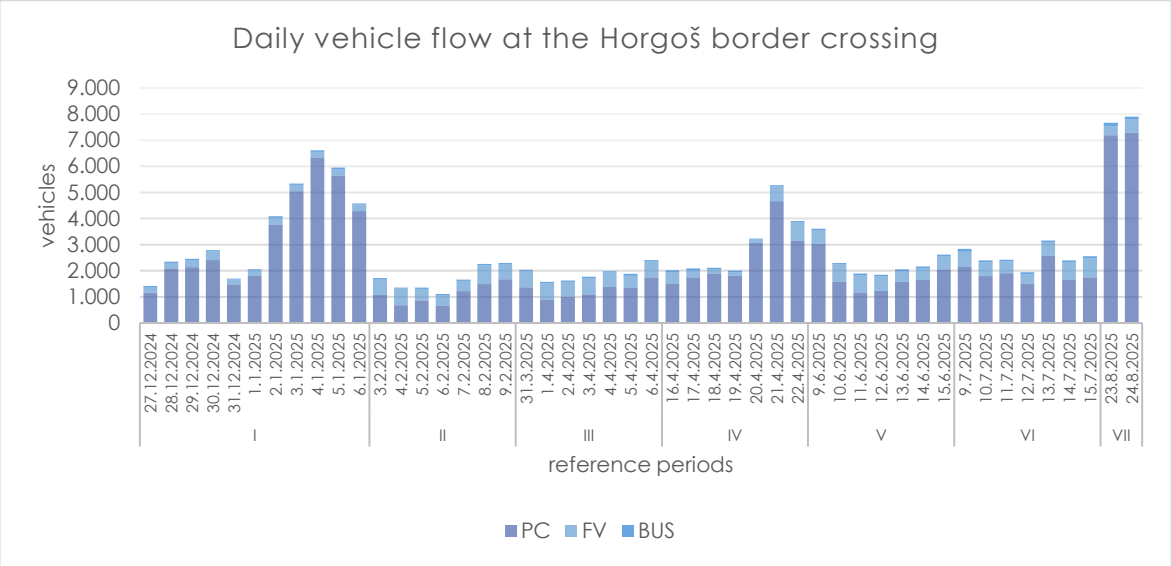


Figure 4-46 Distribution of vehicle flow and category by day at the Horgoš border crossing, reference periods

At the Horgoš border crossing, vehicles with two passengers dominate, accounting for 47% on weekdays and 41% on weekends (Figure 4-47). The average vehicle occupancy at this crossing was 2.1 passengers/PC on weekdays and 2.4 passengers/PC on weekends.

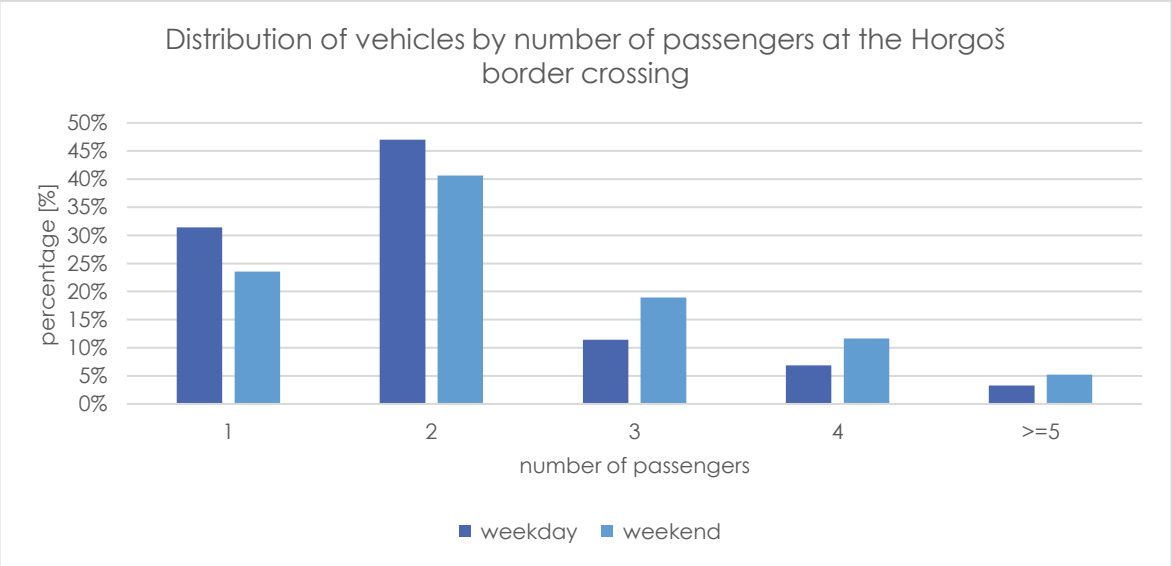


Figure 4-47 Distribution of vehicles by number of passengers at the Horgoš border crossing

### 4.3.7. Border Crossing Horgoš 2

During the analyzed period, the monthly number of passengers leaving the Republic of Serbia and entering Hungary through the Horgoš 2 border crossing ranged from 32, 264 to 56, 833 passengers (Figure 4-48). The average monthly number of passengers was 43,095.

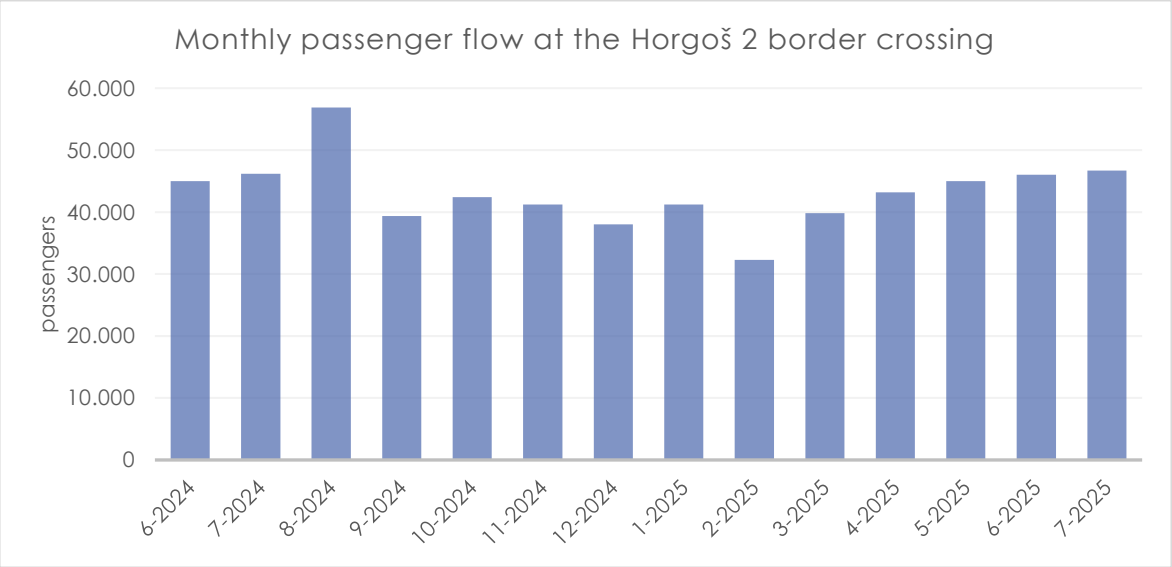


Figure 4-48 Monthly passenger flow distribution at the Horgoš 2 border crossing

Crossing through Horgoš 2 is permitted exclusively for passenger cars. During the analyzed period, the flow of passenger cars remained relatively stable, ranging from 10,872 to 19,421 vehicles per month, with an average of 14,468 PC/month (Figure 4-49). The average vehicle occupancy rate was 2.98 passengers/PC.

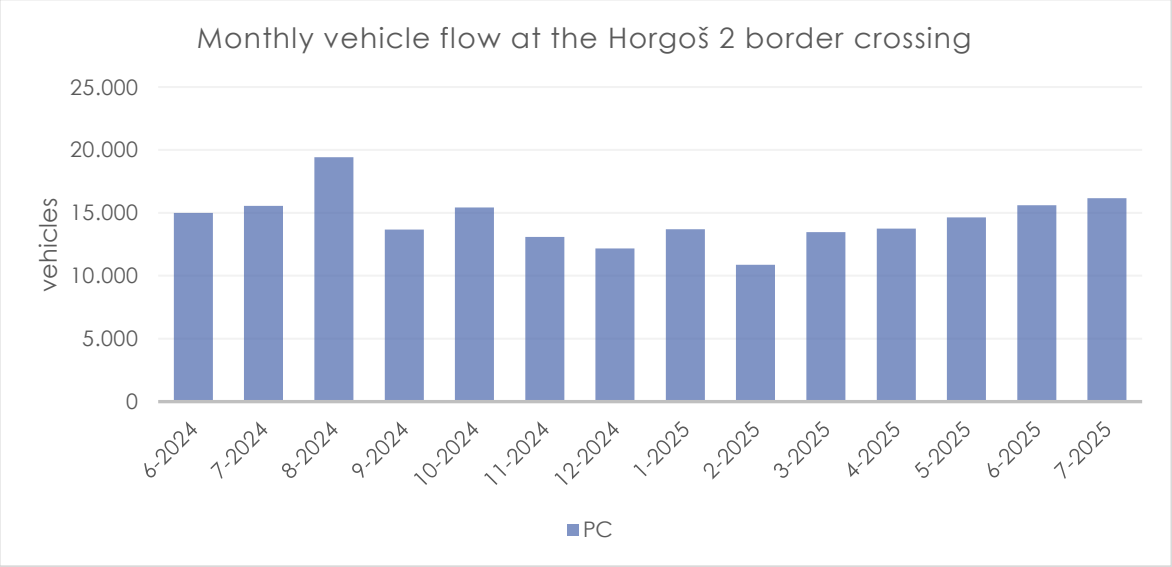


Figure 4-49 Monthly vehicle flow distribution by category at the Horgoš 2 border crossing

#### Border crossing Horgoš 2 – reference periods

Within the defined reference periods, the average daily number of passengers leaving Serbia through the Horgoš 2 border crossing was 1,560 passengers/day. The highest deviation from the average was recorded on August 24, when 3.691 passengers were registered (Figure 4-50).

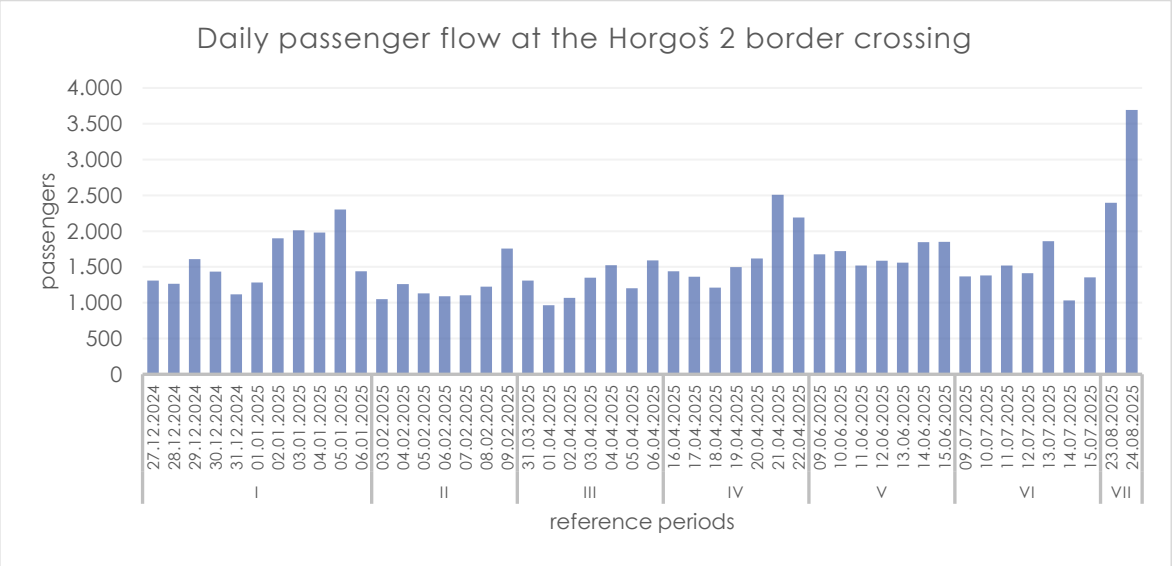


Figure 4-50 Daily passenger flow distribution at the Horgoš 2 border crossing, reference periods

Following figure shows the distribution of daily vehicle flows at the Horgoš 2 border crossing. Within the defined reference periods, the number of passenger cars ranged from 298 (April 1) to 854 (April 21). The average vehicle occupancy rate was 3.06 passengers/PC.

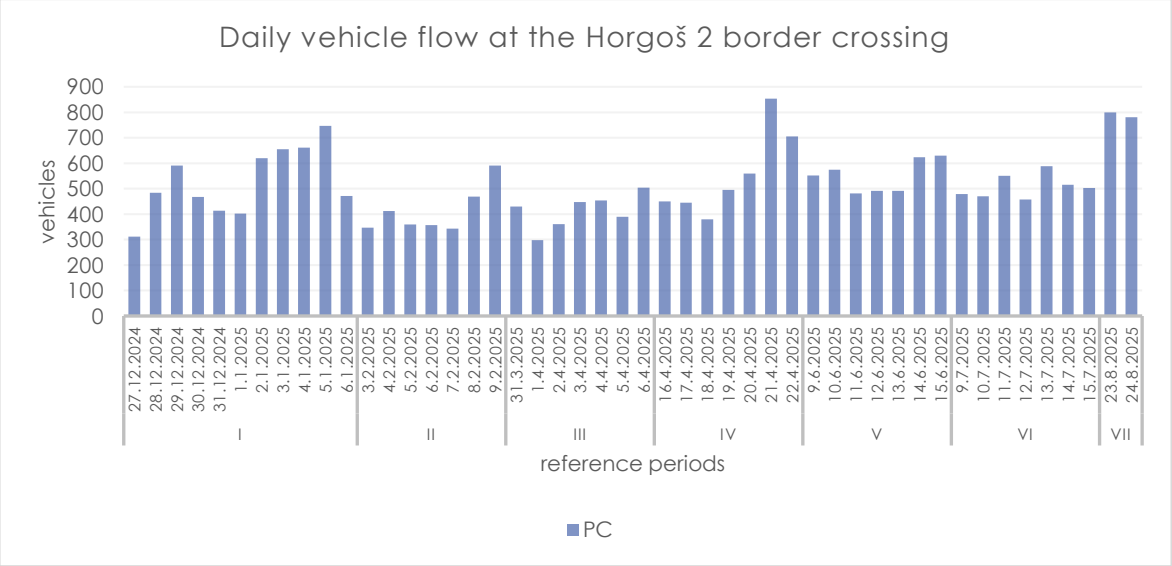


Figure 4-51 Distribution of vehicle flow and category by day at the Horgoš 2 border crossing, reference periods

## Border crossing Horgoš 2 – vehicle occupancy

During weekdays at the Horgoš 2 border crossing, more than half of the vehicles (51%) consist of a single passenger (driver only). In contrast, on weekends, vehicles with two passengers are the most common, accounting for 33% of all traffic. Additionally, vehicles with three or four passengers represent a significant share on weekends, totaling 32%, compared to only 9% on weekdays. The average vehicle occupancy at this crossing was 1.8 passengers/PC on weekdays and 2.6 passengers/PC on weekends.

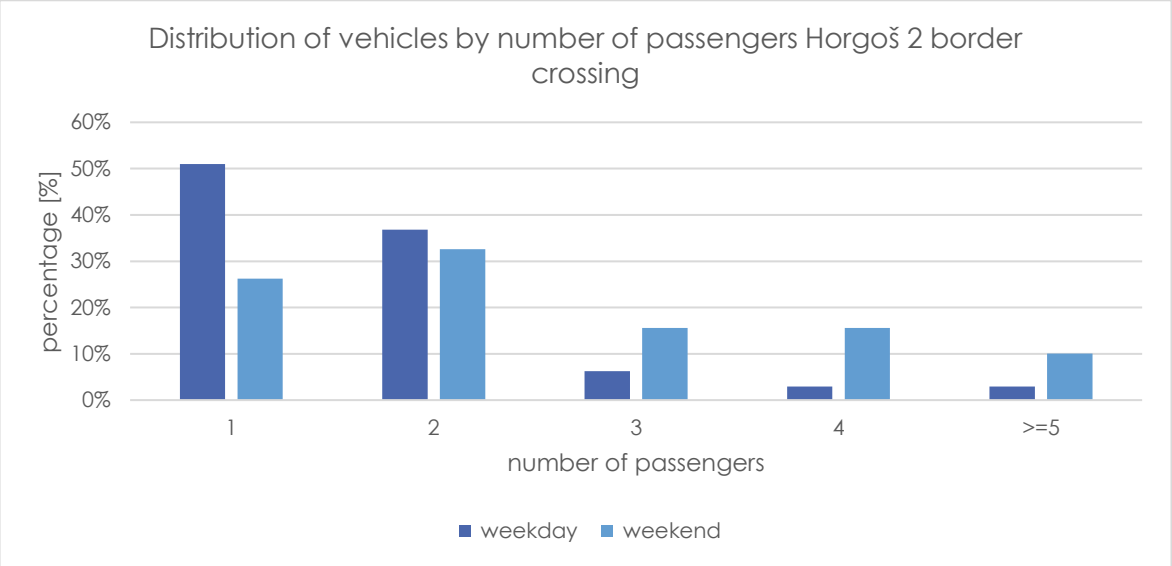


Figure 4-52 Distribution of vehicles by number of passengers at the Horgoš 2 border crossing

### 4.3.8. Border Crossing Đala

During the analyzed period, a total of 412,698 passengers exited the Republic of Serbia through the Đala border crossing, representing an average monthly flow of 29,478 passengers. The highest deviation from the average was recorded in August 2024, when 55,905 passengers were registered — approximately 1.9 times higher than the monthly average (Figure 4-53).

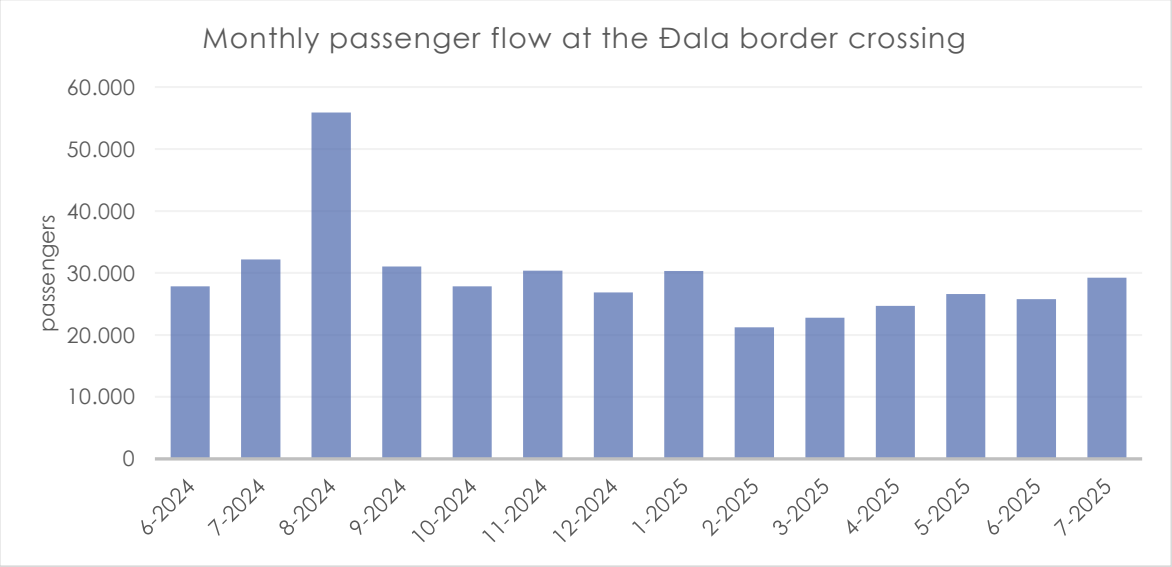


Figure 4-53 Monthly passenger flow distribution at the Đala border crossing

At this border crossing, only passenger car traffic was recorded, while freight vehicles and buses were not present. The monthly flow of passenger car ranged from 6,999 (February 2025) to 18,632 (August 2025), with an average of 10,170 PC/month (Figure 4-54). The average occupancy rate during the analyzed period was 2.90 passengers/PC.

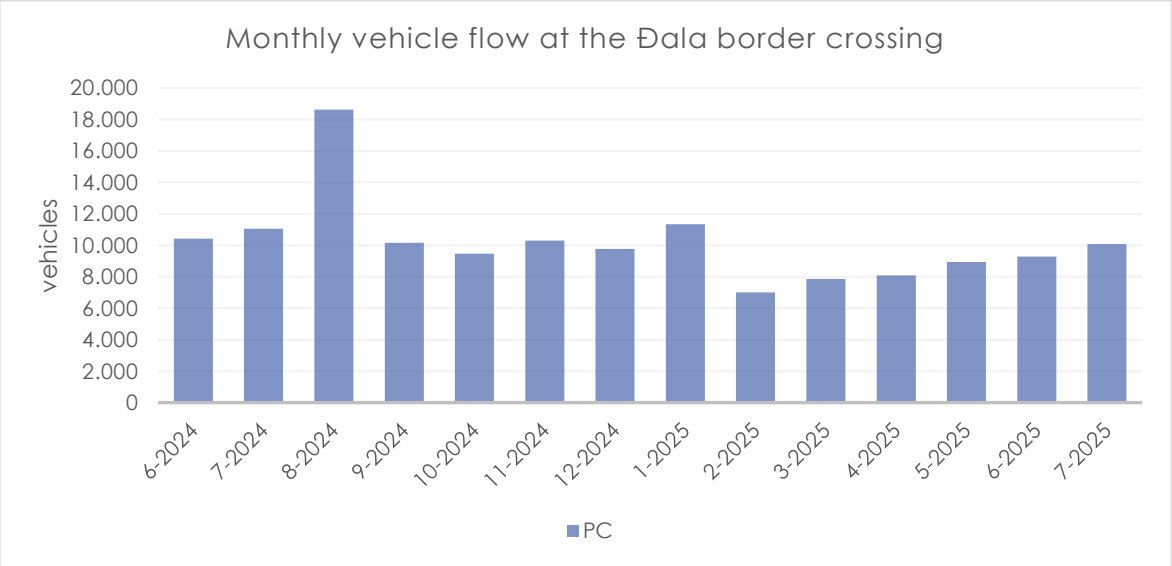


Figure 4-54 Monthly vehicle flow distribution by category at the Đala border crossing

## Border crossing Đala – reference periods

Within the observed reference periods, the average daily number of passengers exiting Serbia through the Đala border crossing was around 1,344 passengers/day (Figure 4-55). A total of 64,526 passengers were recorded over 48 observation days. The highest daily flow was registered on April 22, when 11,803 passengers crossed the border, accounting for approximately 18.3% of the total number of passengers during the reference periods.


Figure 4-55 Daily passenger flow distribution at the Đala border crossing, reference periods

The daily vehicle flow ranged from 123 to 1,079 PC/day, with an average of 385 PC/day (Figure 4-56). The highest values were recorded during seasonal periods — at the beginning of the year, during the summer season, and around Easter holidays. Additionally, higher valumes were observed on weekends compared to weekdays. The average vehicle occupancy rate during the defined reference periods was 33,51 passengers/PC.

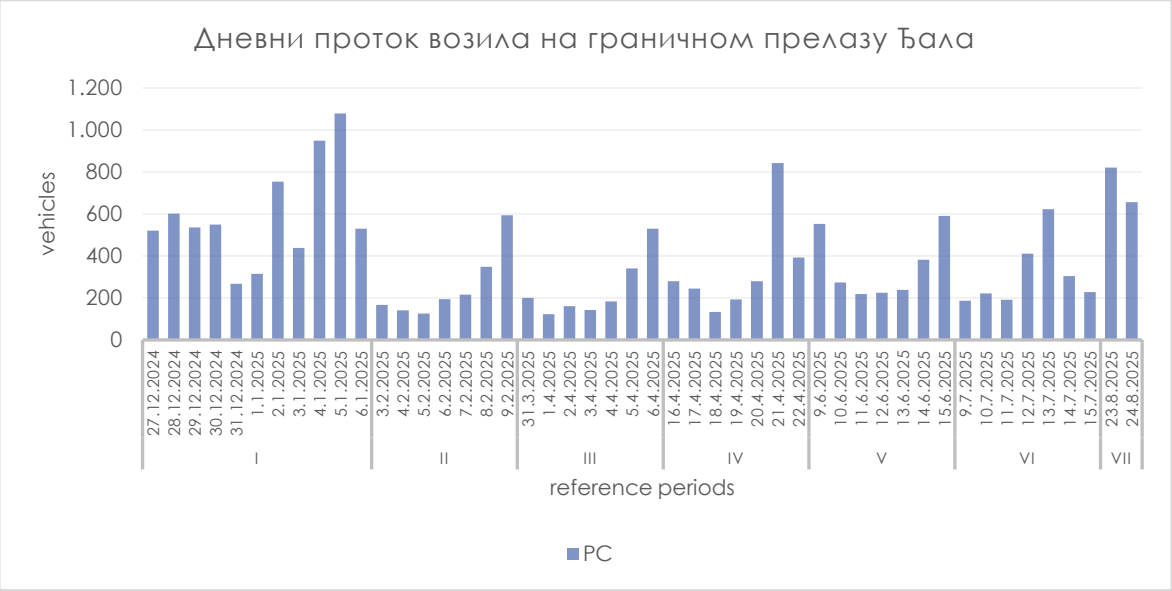


Figure 4-56 Distribution of vehicle flow and category by day at the Đala border crossing, reference periods

## Border crossing Đala – vehicle occupancy

The average occupancy of passenger vehicles at the Đala border crossing was 1.9 passengers/PC on both weekdays and weekends. The distribution of vehicles by number of passengers shows that vehicles with one or two passengers account for the largest share, totaling 77% on weekdays and 81% on weekends (Figure 4-57).

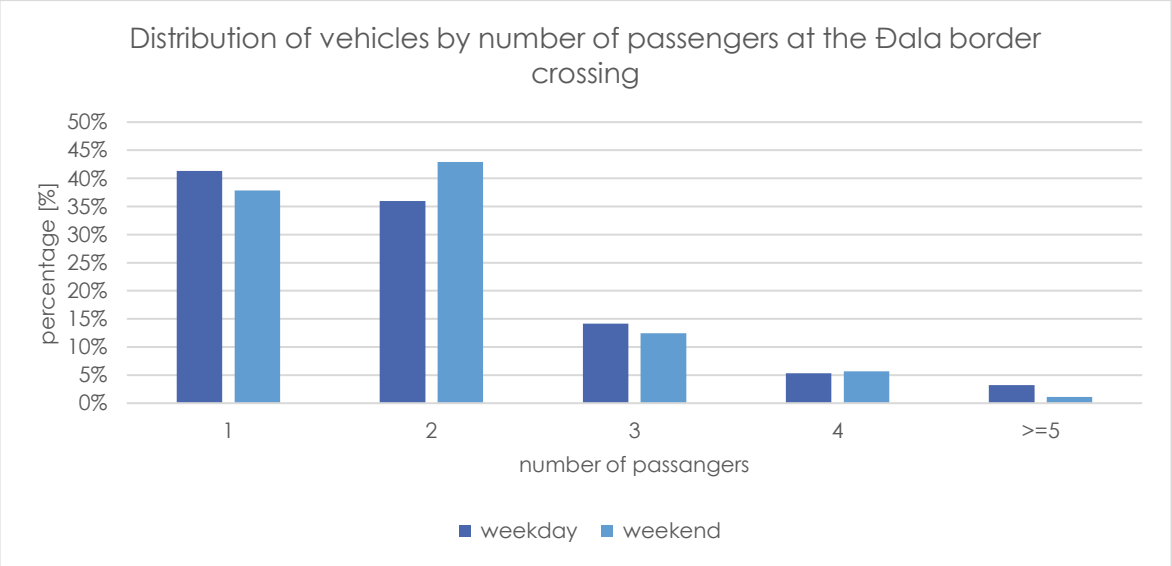


Figure 4-57 Distribution of vehicles by number of passengers at the Đala border crossing

### 4.3.9. Border Crossing Rabe

Figure 4-58 shows the monthly passenger flow distribution at the Rabe border crossing. The monthly number of passengers who ixited the Republic of Serbia and entered Hungary through this crossing ranged from 4,047 (February 2025) to 19,497 (August 2024), with an average monthly value of 6,942 passengers. In other words, approximately 20% of the total number of passengers were recorded during the seasonal peak in August.

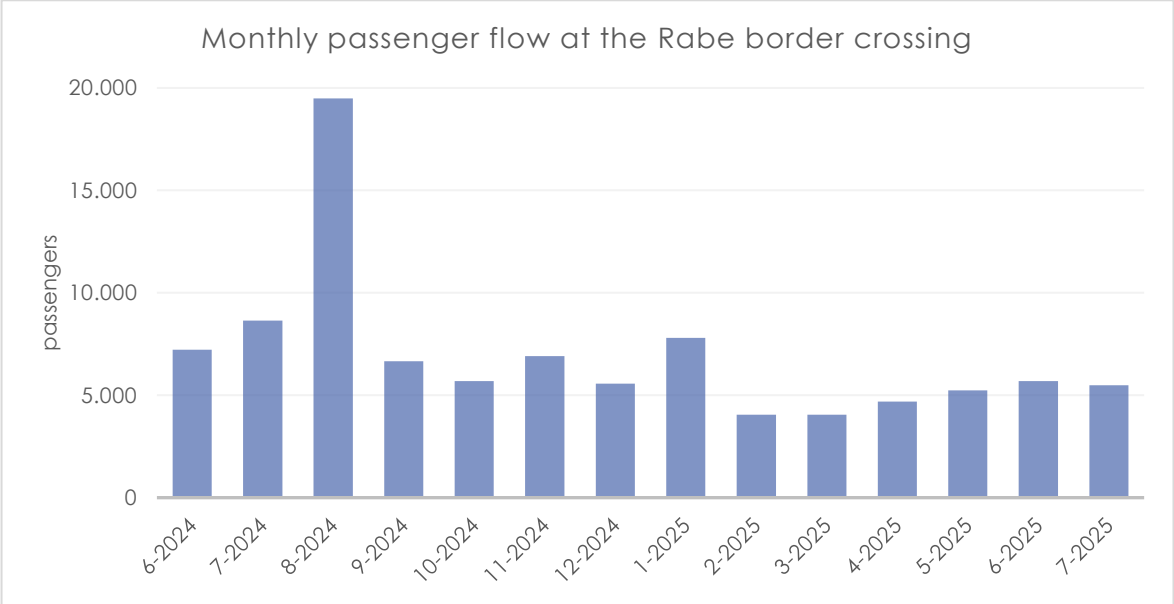


Figure 4-58 Monthly passenger flow distribution at the Rabe border crossing

Only passenger cars use the Rabe border crossing. On average, 2.621 PC/month exited Serbia through this crossing (Figure 4-59). The lowest vehicle flow was recorded in February 2025, with 1,662 vehicles, while the highest was in August 2024, with 6,448 vehicles. The average vehicle occupancy rate during the analyzed period was 2.59 passengers/PC

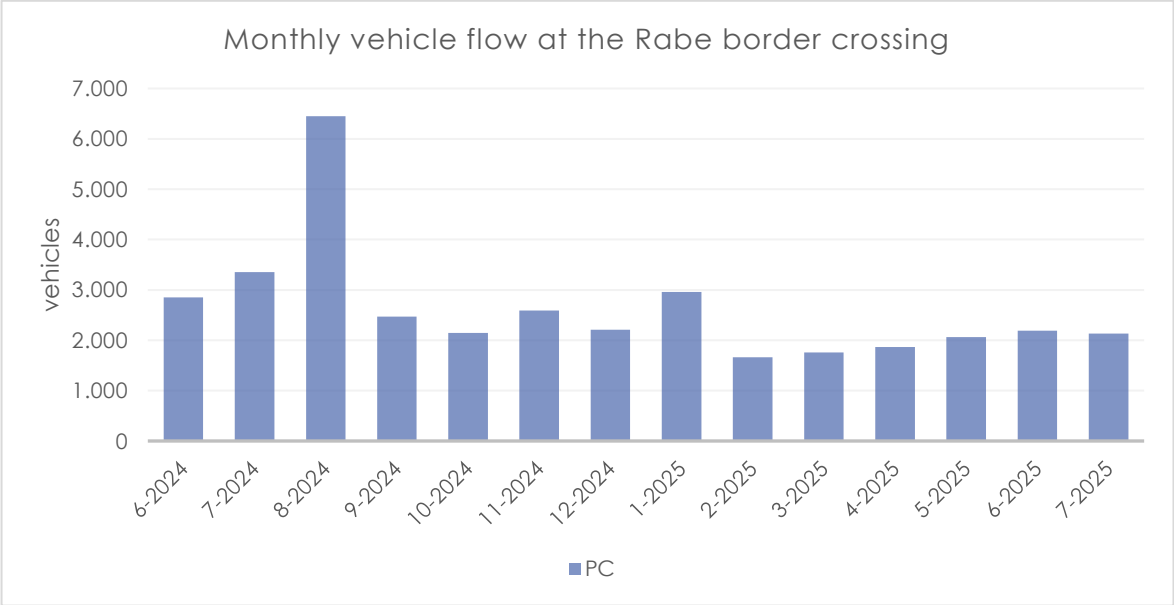


Figure 4-59 Monthly vehicle flow distribution by category at the Rabe border crossing

## Border crossing Rabe – reference periods

Within the reference period, significant variations in daily passenger flows were observed, ranging from 36 to 1,053 passengers/day. The highest flows were recorded at the beginning of 2025 (from January 3 to January 5), as well as on April 21, June 6, and August 23-24, 2025 (Figure 4-60).

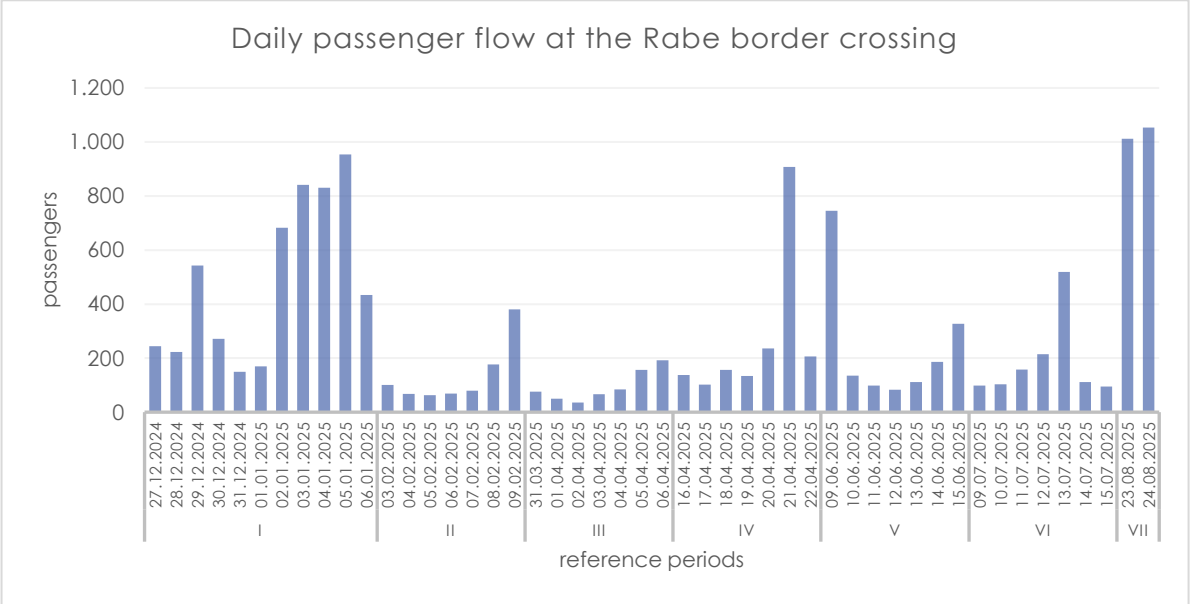


Figure 4-60 Daily passenger flow distribution at the Rabe border crossing, reference periods

Similar to passenger flows, significant variations were also observed in the vehicle flows within the defined reference periods. The daily vehicle flow ranged from 20 to 357 PC/day, with an average value of 107 PC/day (Figure 4-61). The average behicle occupancy rate during the defined reference periods was 2.49 passengers/PC.

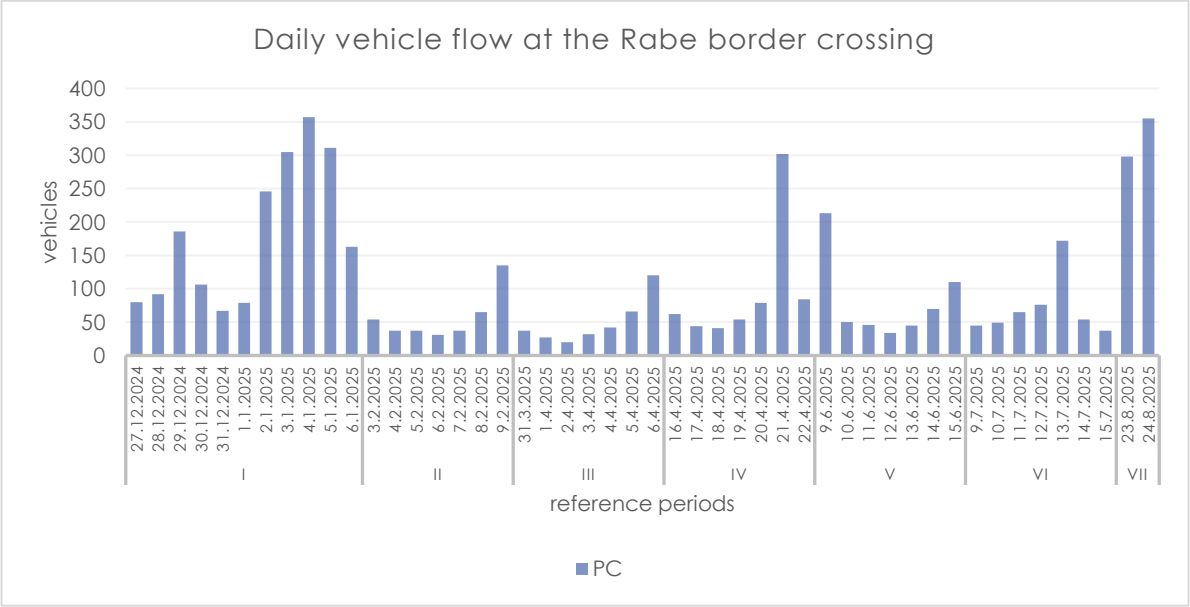


Figure 4-61 Distribution of vehicle flow and category by day at the Rabe border crossing, reference periods

## Border crossing Rabe – vehicle occupancy

At the Rabe border crossing, vehicles with two passengers dominate, accounting for 48% of all vehicles on weekdays and 43% on weekends. In contrast, vehicles with five or more passengers are the least common, making up 6% on weekdays and 5% on weekends (Figure 4-62). The average vehicle occupancy at this crossing was 2.5 passengers/PC on weekdays and 2.4 passengers/PC on weekends.

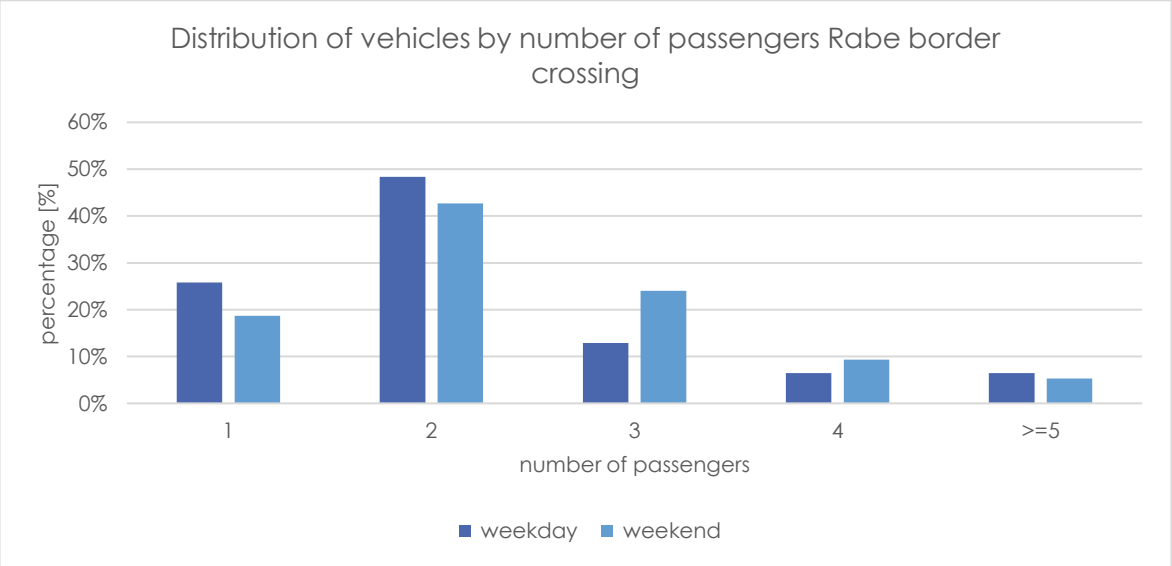


Figure 4-62 Distribution of vehicles by number of passengers at the Rabe border crossing

# 5. ANALYSIS OF WAITING TIME

Within this section, an analysis of the total vehicle waiting time at the border crossings between the Republic of Serbia and the Republic of Hungary is presented. The analysis is based on data collected by the study contractor and refers to the direction of movement from the Republic of Serbia towards the Republic of Hungary.

After statistical processing of hourly means, waiting time is displayed graphically with accompanying descriptions and explanations of the charts for each border crossing. Data on average waiting time are presented as the average hourly value:

1. at the level of the working day (WD) and the weekend (WKD) in the period with customary traffic volumes (off-season profile), and
2. at the level of the working day (WD) and the weekend (WKD) in the period with increased traffic volumes that include seasonal (predominantly tourist) travel and public holidays (season profile).

The results are interpreted through:

- the daily hourly mean (μ),
- the standard deviation (σ) computed from hourly means,
- extremes and the hour of occurrence,
- dominant diurnal periods and thresholds (μ+σ).

Detailed hourly profiles for each border crossing are presented in the continuation of this chapter.

Although the presented indicators are based on systematic processing of hourly means, under real operating conditions at border crossings there is a certain likelihood that individual values deviate from the displayed ranges. These deviations arise from the combined influence of operational, infrastructural, and external factors that are not fully covered by the present analysis. The key sources of variability are listed below:

- disturbances in the traffic flow (uneven vehicle arrivals),
- staffing capacity and shift allocation of the border police,
- staffing capacity and shift allocation of the customs service,
- the method and type of passenger and vehicle control,
- irregularities in the operation of the information and communication system (passport control, communications).

## 5.1. Bački Breg – Hercegszántó Border Crossing

Processing of the data for the Bački Breg border crossing, for the WD off-season profile, determined a daily hourly mean of μ=5.5 min, with a standard deviation of σ=1.6. The minimum observed waiting time is 3.2 min and occurs during 02:00–03:00, while the maximum observed waiting time is 8.4 min and occurs during 15:00–16:00. The dominant time window is the afternoon (12–18) (≈7.3 min). Based on the μ+σ threshold, the most pronounced peak hours are 15:00–16:00 (8.4 min), 16:00–17:00 (8.3 min), 17:00–18:00 (8.0 min), 18:00–19:00 (7.6 min). In the WKD off-season profile, the daily hourly mean is μ=7.5 min, with a standard deviation of σ=4.3. The minimum observed waiting time is 3.8 min and occurs during 02:00–03:00. The maximum observed waiting time is 21.1 min and occurs during 15:00–16:00. The dominant time window is the afternoon (12–18) (≈12.4 min). Based on the μ+σ threshold, the most pronounced peak hours are 15:00–16:00 (21.1 min), 16:00–17:00 (17.4 min), 17:00–18:00 (13.6 min).

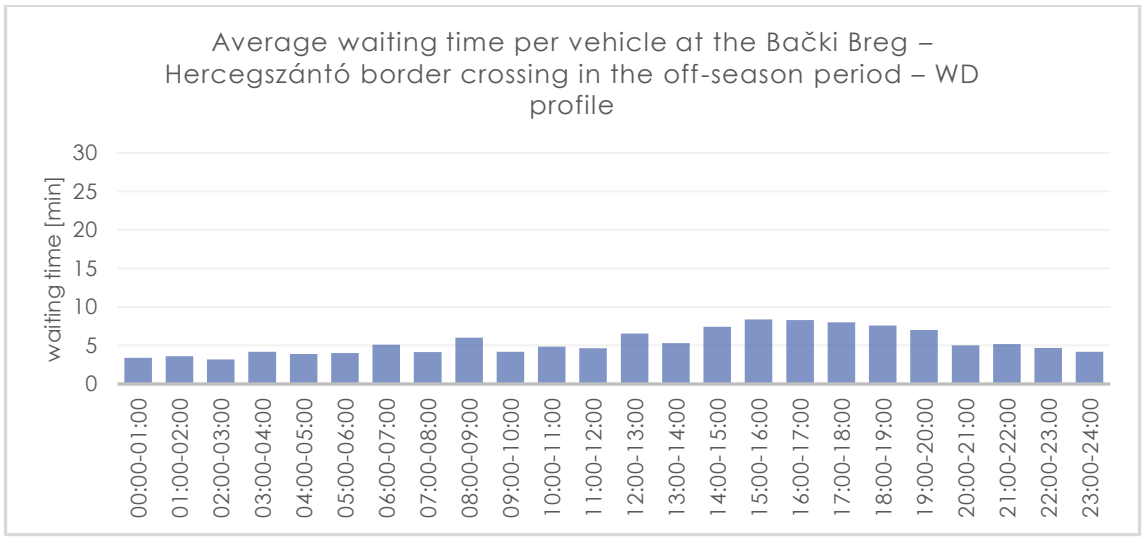


Figure 5-1 Average waiting time per vehicle at the Bački Breg – Hercegszántó border crossing in the off-season period – WD profile

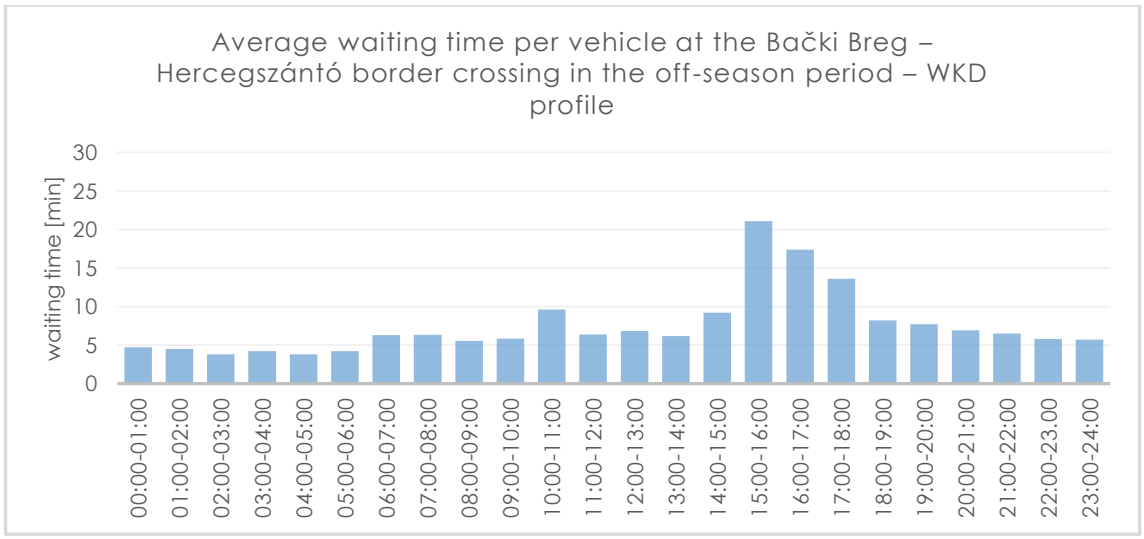


Figure 5-2 Average waiting time per vehicle at the Bački Breg – Hercegszántó border crossing in the off-season period – WKD profile

Analysis for the WD season profile determined a daily hourly mean of μ=8.7 min, with a standard deviation of σ=4.2. The minimum observed waiting time is 3.5 min and occurs during 03:00–04:00, the maximum observed waiting time is 19.3 min and occurs during 14:00–15:00.

The dominant time window is the afternoon (12–18) (≈12.3 min). Based on the μ+σ threshold, the most pronounced peak hours are: 14:00–15:00 (19.3 min), 10:00–11:00 (16.9 min), 15:00–16:00 (14.5 min), 18:00–19:00 (14.1 min). The daily hourly mean for the WKD season profile is μ=16.0 min, with a standard deviation of σ=6.8. The minimum observed waiting time is 5.5 min and occurs in the night period after 21:0. The maximum observed waiting time is 33.1 min and occurs during 15:00–16:00. The dominant time window is the afternoon (12–18) (≈23.3 min). Based on the μ+σ threshold, the most pronounced peak hours are: 15:00–16:00 (33.1 min), 14:00–15:00 (27.5 min), 16:00–17:00 (26.4 min).

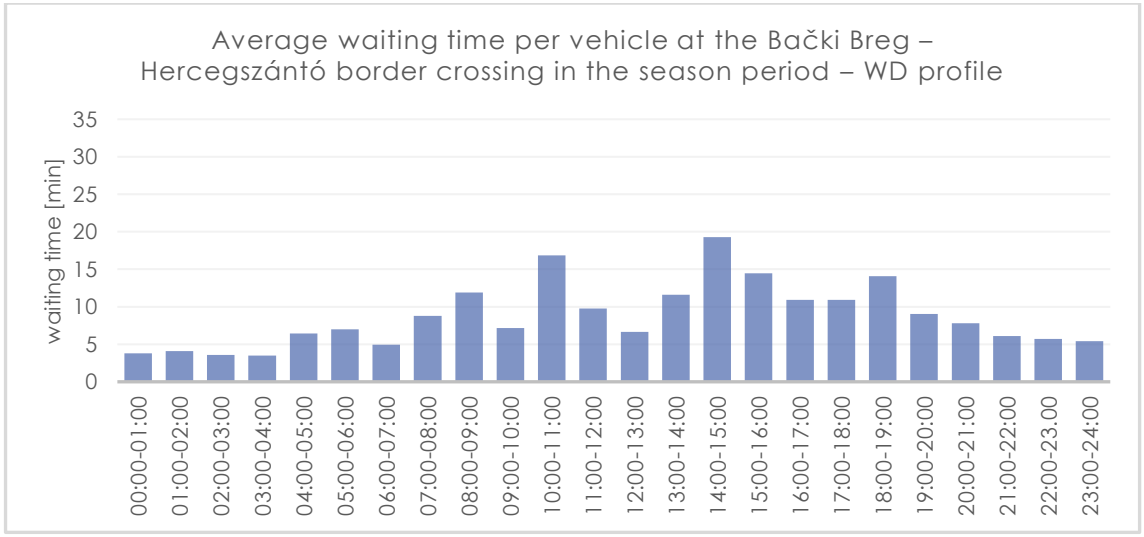


Figure 5-3 Average waiting time per vehicle at the Bački Breg – Hercegszántó border crossing in the season period – WD profile

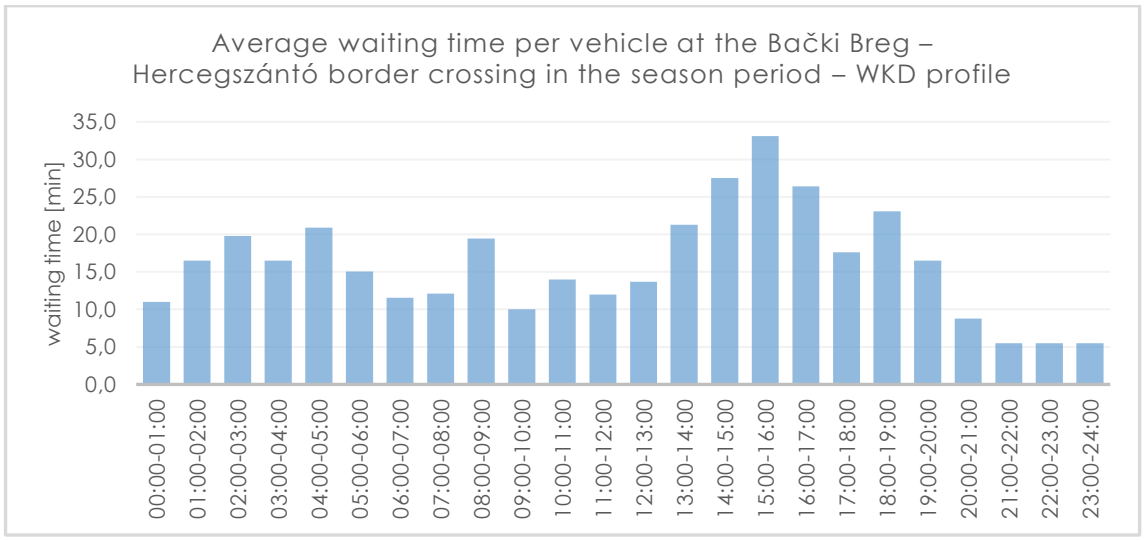


Figure 5-4 Average waiting time per vehicle at the Bački Breg – Hercegszántó border crossing in the season period – WKD profile

In the comparative analysis of the season and off-season periods for the WD profile, μ_season − μ_off-season = +3.0 min (+55%), with the peak hour shifted (15:00–16:00 → 14:00–15:00), while for the WKD profile the relation is μ_season − μ_off-season = +9.0 min (+116%), with the peak hour stable (15:00–16:00 → 15:00–16:00).

## 5.2. Rastina – Bácsszentgyörgy Border Crossing

Processing of the data for the Rastina border crossing, for the WD off-season profile, determined a daily hourly mean of μ=5.9 min, with a standard deviation of σ=2.7. The minimum observed waiting time is 3.0 min and occurs during 13:00–14:00, while the maximum observed waiting time is 13.6 min and occurs during 14:00–15:00. The dominant time window is the afternoon (12–18) (≈6.7 min). Based on the μ+σ threshold, the most pronounced peak hour is 14:00–15:00 (13.6 min). In the WKD off-season profile, the daily hourly mean is μ=9.7 min, with a standard deviation of σ=6.8. The minimum observed waiting time is 4.0 min and occurs during 07:00–08:00, while the maximum observed waiting time is 24.7 min and occurs during 15:00–16:00. The dominant time window is the afternoon (12–18) (≈14.0 min). Based on the μ+σ threshold, the most pronounced peak hours are 15:00–16:00 (24.7 min), 16:00–17:00 (18.3 min), 17:00–18:00 (17.4 min).

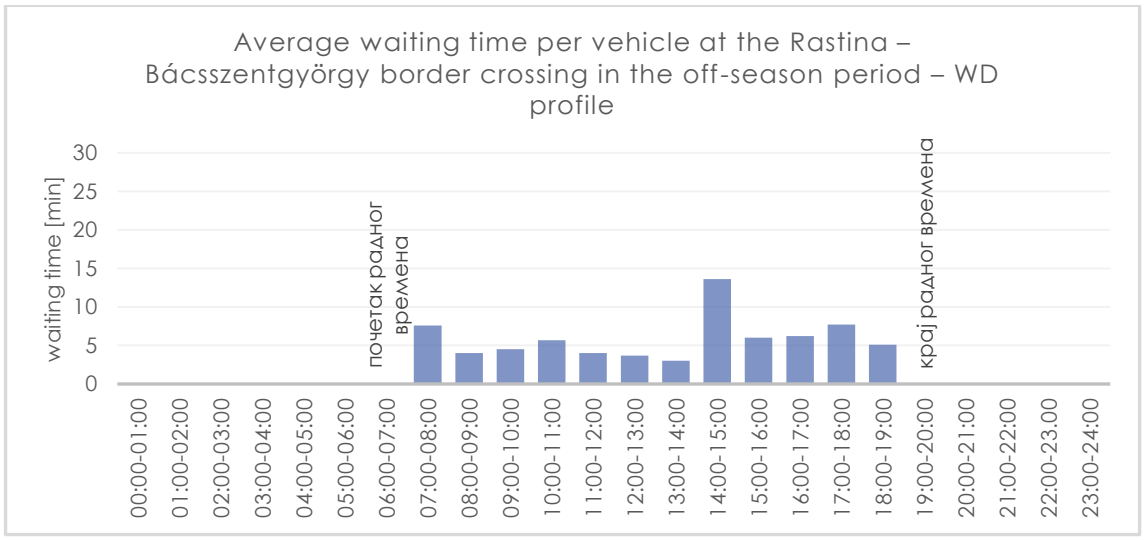


Figure 5-5 Average waiting time per vehicle at the Rastina – Bácsszentgyörgy border crossing in the off-season period – WD profile

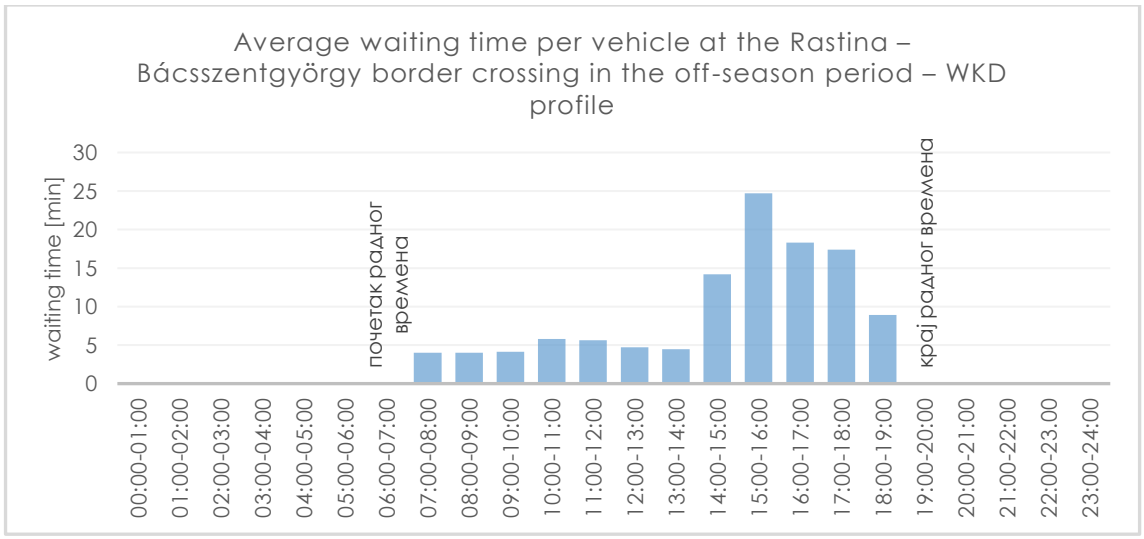


Figure 5-6 Average waiting time per vehicle at the Rastina – Bácsszentgyörgy border crossing in the off-season period – WKD profile

Processing of the data for the WD season profile determined a daily hourly mean of μ=11.7 min, with a standard deviation of σ=3.4. The minimum observed waiting time is 8.1 min and occurs during 07:00–08:00, while the maximum observed waiting time is 20.1 min and occurs

during 14:00–15:00. The dominant time window is the afternoon (12–18) (≈13.7 min). Based on the μ+σ threshold, the most pronounced peak hours are: 14:00–15:00 (20.1 min), 17:00–18:00 (15.7 min). At WKD season profile the daily hourly mean is μ=19.9 min, with a standard deviation of σ=8.9. The minimum observed waiting time is 8.3 min and occurs during 07:00–08:00, while the maximum observed waiting time is 36.7 min and occurs during 17:00–18:00. The dominant time window is the afternoon (12–18) (≈26.2 min). Based on the μ+σ threshold, the most pronounced peak hours are: 17:00–18:00 (36.7 min), 16:00–17:00 (35.3 min), 15:00–16:00 (29.0 min).

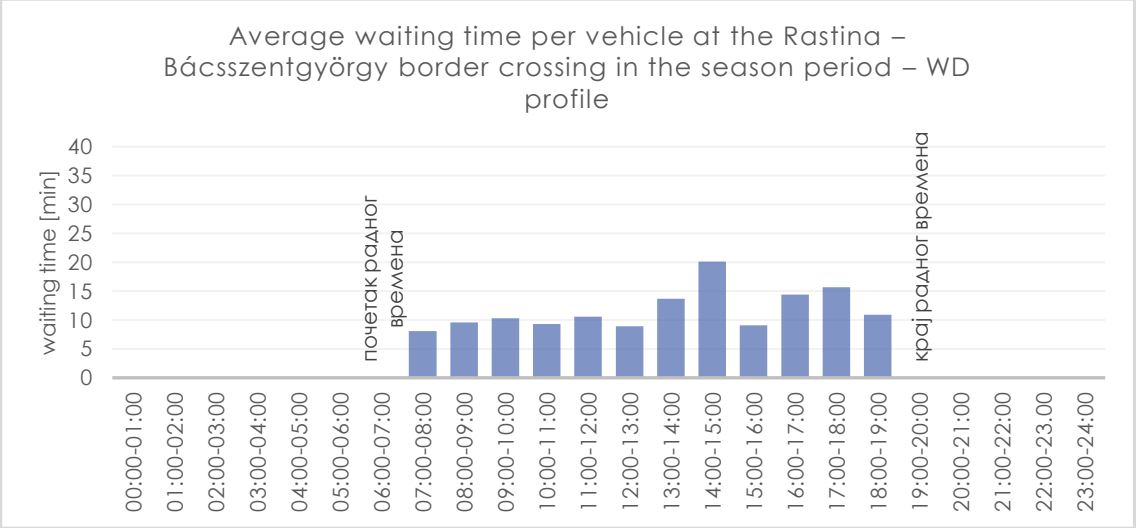


Figure 5-7 Average waiting time per vehicle at the Rastina – Bácsszentgyörgy border crossing in the season period – WD profile

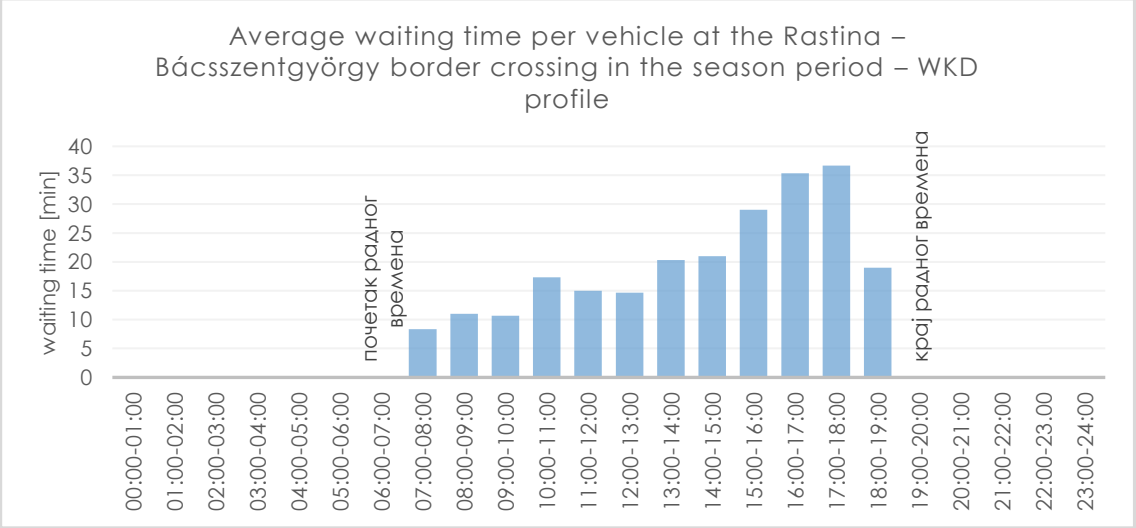


Figure 5-8 Average waiting time per vehicle at the Rastina – Bácsszentgyörgy border crossing in the season period – WKD profile

In the comparative analysis of the season and off-season periods for the WD profile, the difference is μ_season − μ_off-season = +5.8 min (+98%), with the peak hour stable (14:00–15:00 → 14:00–15:00). In the WKD profile, the difference is μ_season − μ_off-season = +10.2 min (+105%), and the peak hour is shifted (15:00–16:00 → 17:00–18:00).

## 5.3. Bajmok – Bácsalmás Border Crossing

Processing of the data for the Bajmok border crossing, for the WD off-season profile, determined a daily hourly mean of μ=7.0 min, with a standard deviation of σ=1.5. The minimum observed waiting time is 5.2 min and occurs during 18:00–19:00, while the maximum observed waiting time is 9.8 min and occurs during 07:00–08:00. The dominant time window is the morning (06–12) (≈7.3 min). Based on the μ+σ threshold, the most pronounced peak hours are 07:00–08:00 (9.8 min), 13:00–14:00 (8.7 min). Observing the WKD off-season profile, the daily hourly mean is μ=15.5 min, with a standard deviation of σ=6.4. The minimum observed waiting time is 5.0 min and occurs during 07:00–08:00, while the maximum observed waiting time is 24.1 min and occurs during 15:00–16:00. The dominant time window is the afternoon (12–18) (≈21.2 min). Based on the μ+σ threshold, the most pronounced peak hours are 15:00–16:00 (24.1 min), 16:00–17:00 (22.9 min).

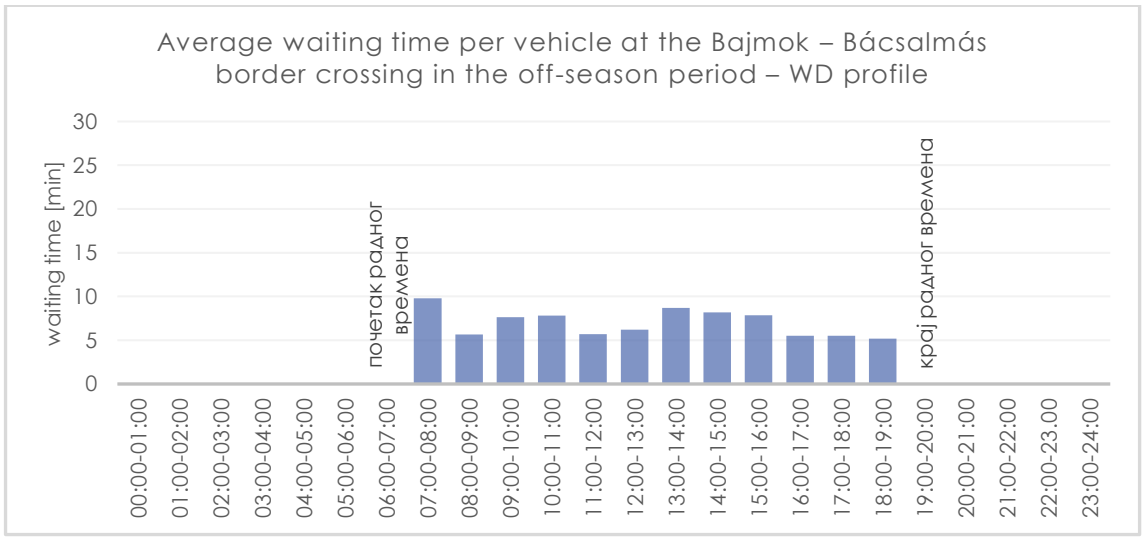


Figure 5-9 Average waiting time per vehicle at the Bajmok – Bácsalmás border crossing in the off-season period – WD profile

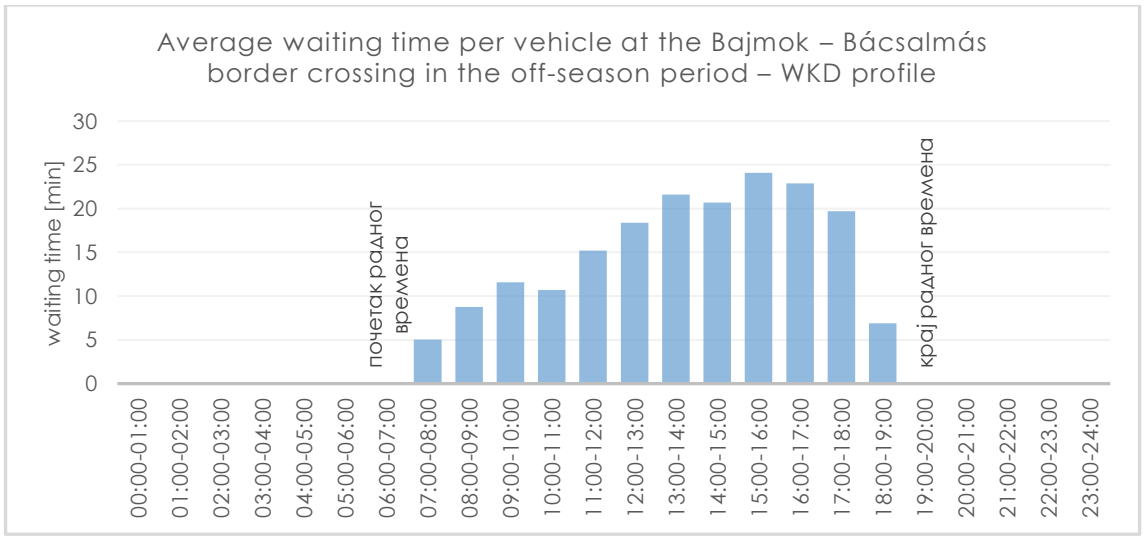


Figure 5-10 Average waiting time per vehicle at the Bajmok – Bácsalmás border crossing in the off-season period – WKD profile

Processing of the data for the Bajmok border crossing, for the WD season profile, determined a daily hourly mean of μ=11.3 min, with a standard deviation of σ=5.6. The minimum observed waiting time is 6.4 min and occurs during 18:00–19:00, while the maximum observed waiting

time is 25.2 min and occurs during 12:00–13:00. The dominant time window is the afternoon (12–18) (≈14.2 min). Based on the μ+σ threshold, the most pronounced peak hours are: 12:00–13:00 (25.2 min), 13:00–14:00 (21.0 min). For the WKD season profile, the daily hourly mean is μ=26.8 min, with a standard deviation of σ=7.6. The minimum observed waiting time is 16.7 min and occurs during 09:00–10:00. The maximum observed waiting time during the season period is 42.3 min and occurs during 12:00–13:00. The dominant time window, as on working days, is the afternoon (12–18) (≈28.6 min). Based on the μ+σ threshold, the most pronounced peak hours are: 12:00–13:00 (42.3 min), 11:00–12:00 (36.3 min), 13:00–14:00 (35.7 min).

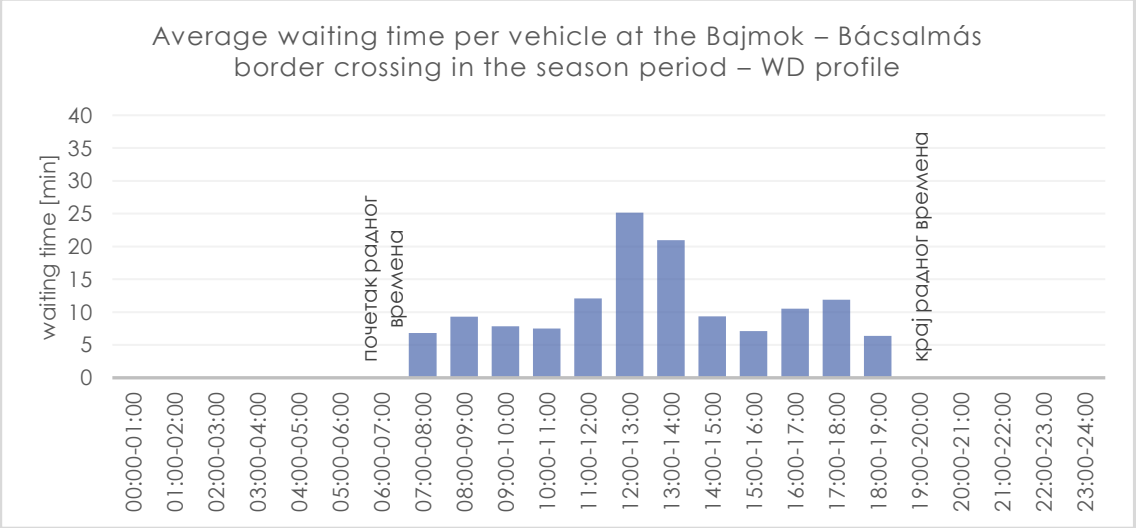


Figure 5-11 Average waiting time per vehicle at the Bajmok – Bácsalmás border crossing in the season period – WD profile

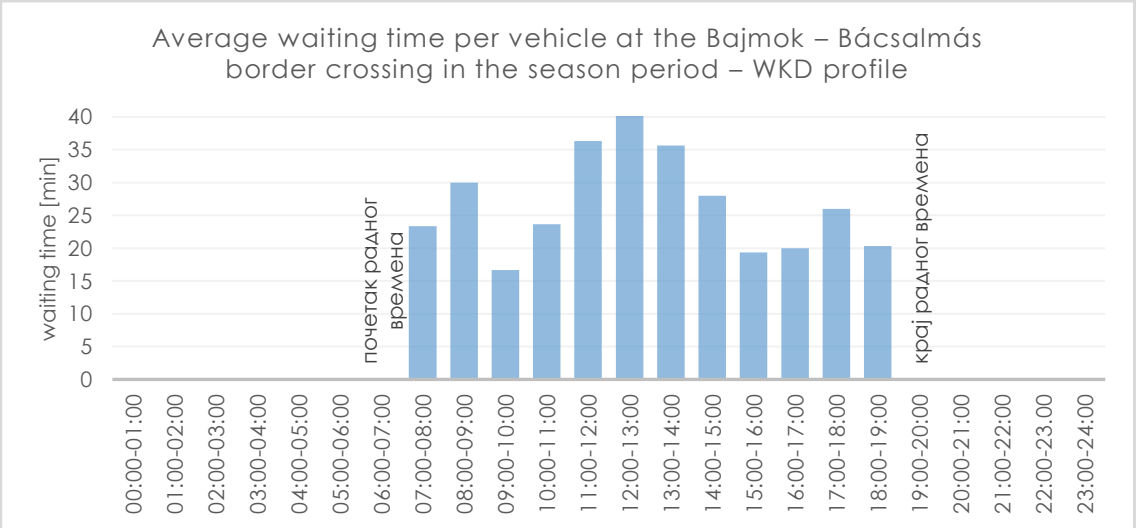


Figure 5-12 Average waiting time per vehicle at the Bajmok – Bácsalmás border crossing in the season period – WKD profile

In the comparative analysis of the season and off-season periods for the WD profile, the difference is μ_season − μ_off-season = +4.3 min (+61%), with the peak hour shifted (07:00–08:00 → 12:00–13:00). In the WKD profile, the difference in the mean value is μ_season − μ_off-season = +11.3 min (+73%), with the peak hour shifted (15:00–16:00 → 12:00–13:00).

## 5.4. Kelebija – Tompa Border Crossing

At the Kelebija border crossing, for the WD off-season profile, a daily hourly mean of μ=17.7 min was determined, with a standard deviation of σ=12.6. The minimum observed waiting time is 7.6 min and occurs during 23:00–00:00, while the maximum observed waiting time is 55.1 min and occurs during 15:00–16:00. The dominant time window is the afternoon (12–18) (≈33.4 min). Based on the μ+σ threshold, the most pronounced peak hours are 15:00–16:00 (55.1 min), 16:00–17:00 (45.7 min), 14:00–15:00 (37.9 min). For the WKD off-season profile, a daily hourly mean of μ=26.4 min was determined, with a standard deviation of σ=16.2. The minimum observed waiting time is 6.4 min and occurs during 05:00–06:00, while the maximum observed waiting time is 62.4 min and occurs during 14:00–15:00. The dominant time window is the afternoon (12–18) (≈44.6 min). Based on the μ+σ threshold, the most pronounced peak hours are 14:00–15:00 (62.4 min), 13:00–14:00 (52.9 min), 19:00–20:00 (52.1 min), 20:00–21:00 (44.5 min).

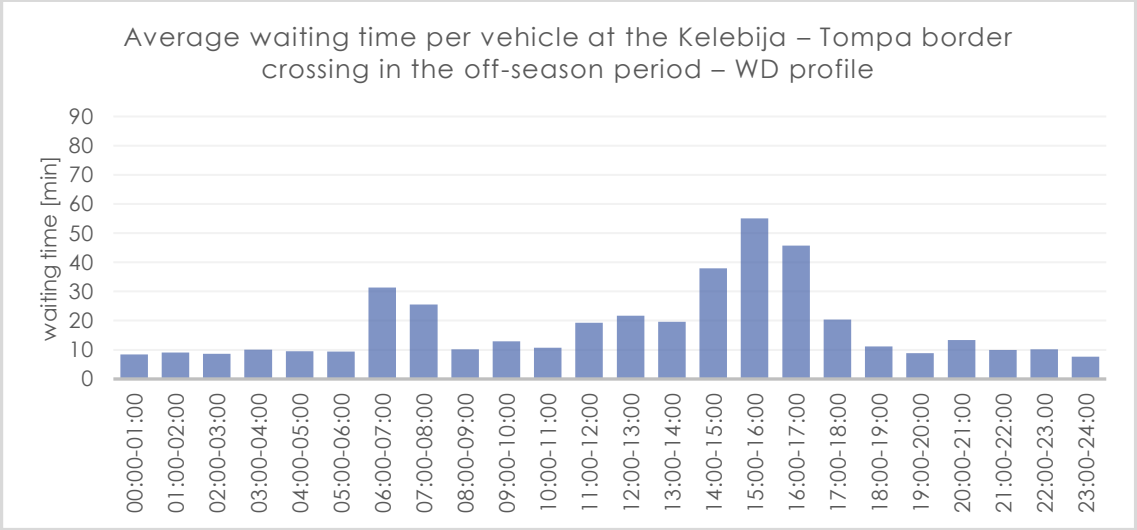


Figure 5-13 Average waiting time per vehicle at the Kelebija – Tompa border crossing in the off-season period – WD profile

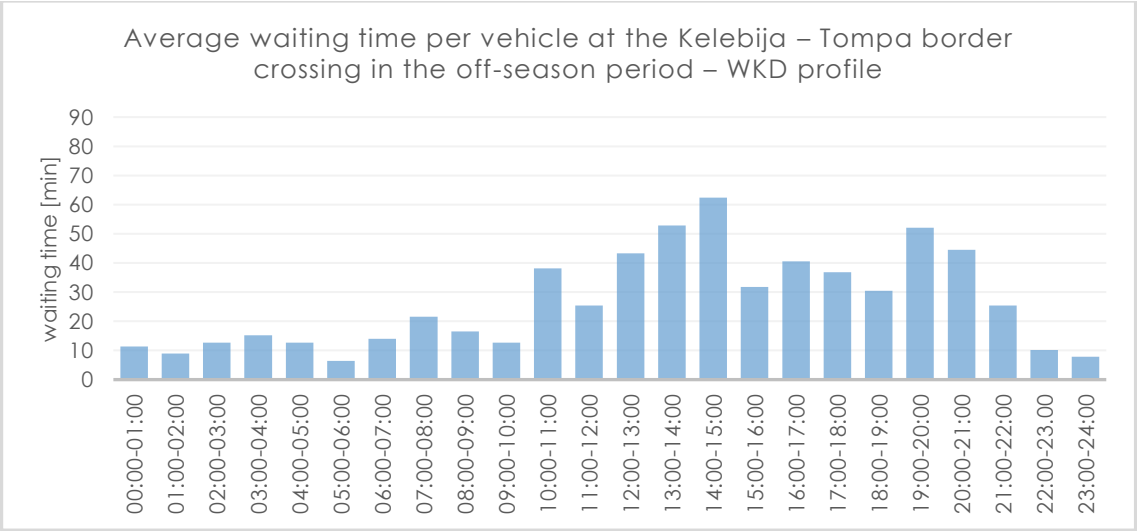


Figure 5-14 Average waiting time per vehicle at the Kelebija – Tompa border crossing in the off-season period – WKD profile

Processing of the data for the Kelebija border crossing for the season period, for the WD season profile, determined a daily hourly mean of μ=39.6 min, with a standard deviation of σ=17.9. The minimum observed waiting time is 13.8 min and occurs during 04:00–05:00, while the

maximum observed waiting time is 78.9 min and occurs during 14:00–15:00. The dominant time window is the afternoon (12–18) (≈58.7 min). Based on the μ+σ threshold, the most pronounced peak hours are 14:00–15:00 (78.9 min), 11:00–12:00 (74.4 min), 15:00–16:00 (66.7 min), 12:00–13:00 (61.9 min). On weekend days, during the season, the daily hourly mean is μ=44.5 min, with a standard deviation of σ=15.8. The minimum observed waiting time is 21.2 min and occurs during 20:00–21:00, while the maximum observed waiting time is 76.3 min and occurs during 14:00–15:00. The dominant time window is the afternoon (12–18) (≈59.0 min). Based on the μ+σ threshold, the most pronounced peak hours are: 14:00–15:00 (76.3 min), 15:00–16:00 (76.3 min), 18:00–19:00 (68.6 min), 16:00–17:00 (64.1 min).

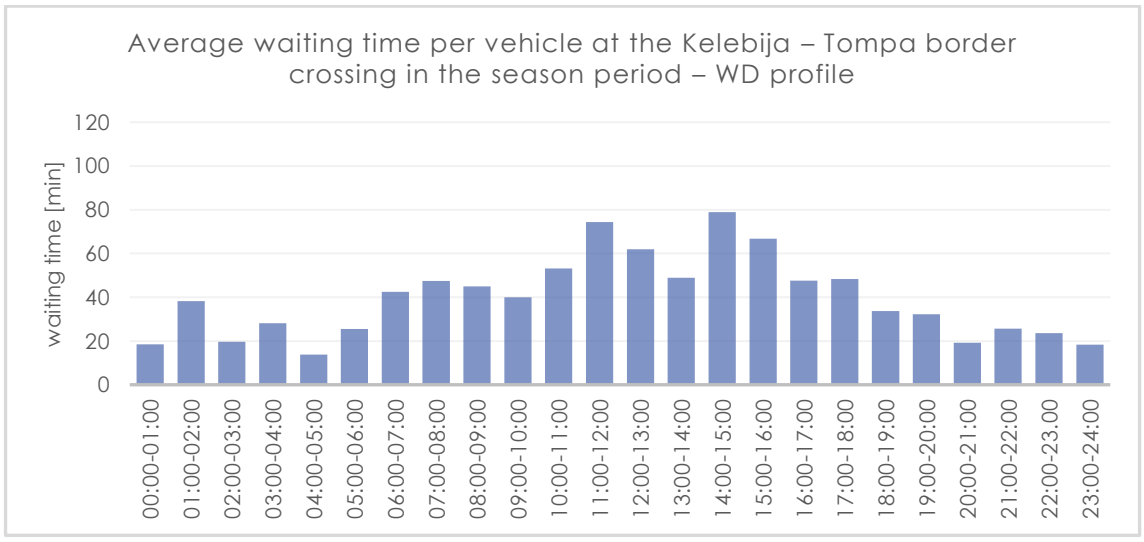


Figure 5-15 Average waiting time per vehicle at the Kelebija – Tompa border crossing in the season period – WD profile

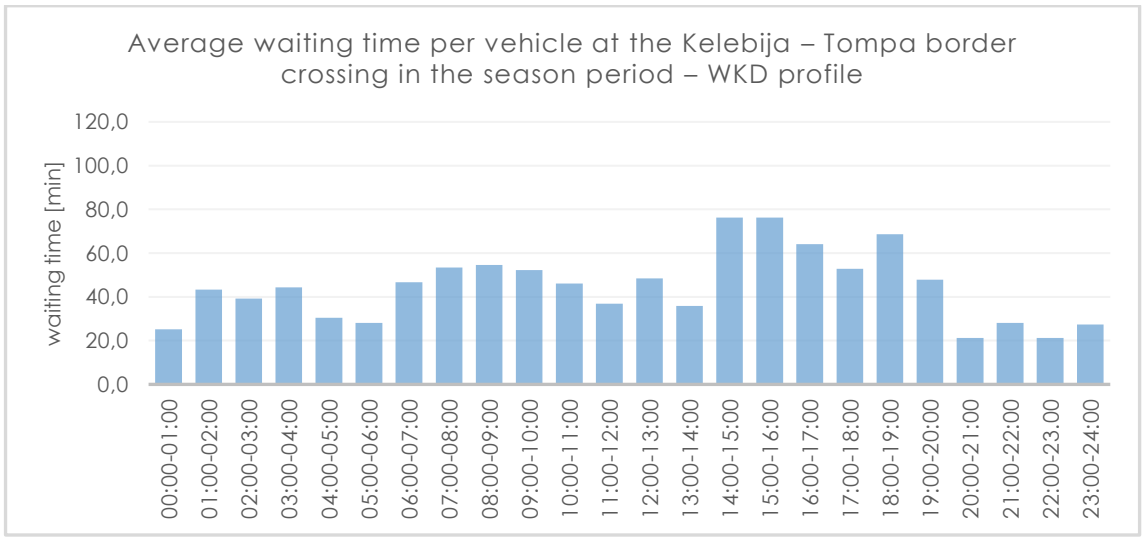


Figure 5-16 Average waiting time per vehicle at the Kelebija – Tompa border crossing in the season period – WKD profile

In the comparative analysis of the season and off-season periods for the WD profile, the difference is μ_season − μ_off-season = +22.8 min (+123%), with the peak hour shifted (15:00–16:00 → 14:00–15:00). For the WKD profile, the difference is μ_season − μ_off-season = +18.7 min (+67%), with the peak hour remaining unchanged (14:00–15:00).

## 5.5. Bački Vinogradi – Ásotthalom Border Crossing

Analysis and processing of the data for the Bački Vinogradi border crossing, for the WD off-season profile, determined a daily hourly mean of μ=19.2 min, with a standard deviation of σ=7.8. The minimum observed waiting time is 9.6 min and occurs during 11:00–12:00, while the maximum observed waiting time is 32.7 min and occurs during 07:00–08:00. The dominant time window is the afternoon (12–18) (≈20.3 min). Based on the μ+σ threshold, the most pronounced peak hours are: 07:00–08:00 (32.7 min), 15:00–16:00 (31.6 min), 16:00–17:00 (27.4 min).

For the WKD off-season profile, a daily hourly mean of μ=48.6 min was determined, with a high standard deviation of σ=21.3. The minimum average waiting time during the weekend is 17.9 min and occurs during 18:00–19:00, while the maximum occurs during 14:00–15:00 and amounts to 97.4 min. The dominant time window is the afternoon (12–18) (≈53.4 min). Based on the μ+σ threshold, the most pronounced peak hours are: 14:00–15:00 (97.4 min), 09:00–10:00 (77.8 min).

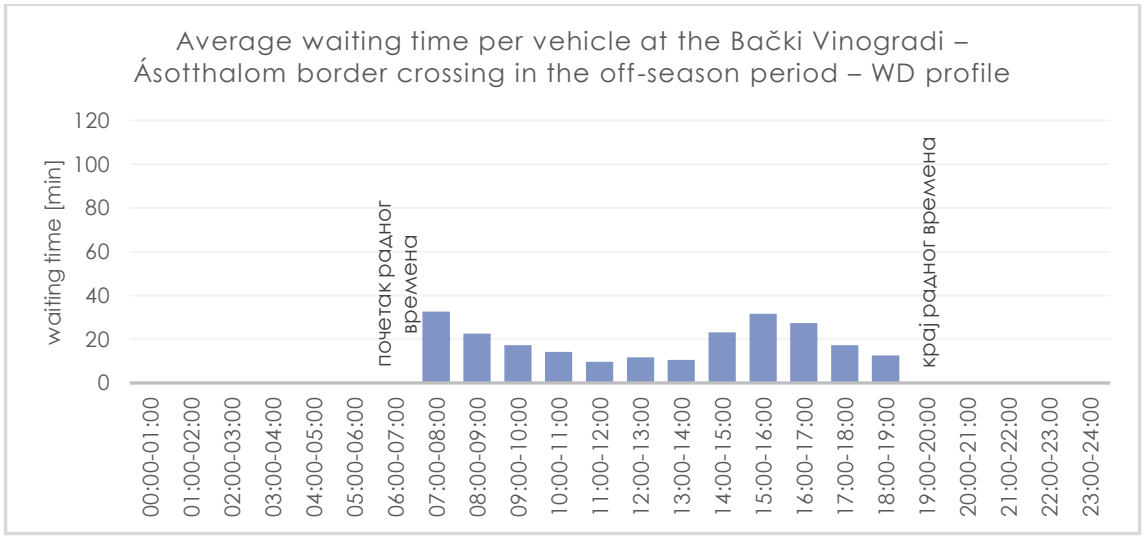


Figure 5-17 Average waiting time per vehicle at the Bački Vinogradi – Ásotthalom border crossing in the off-season period – WD profile

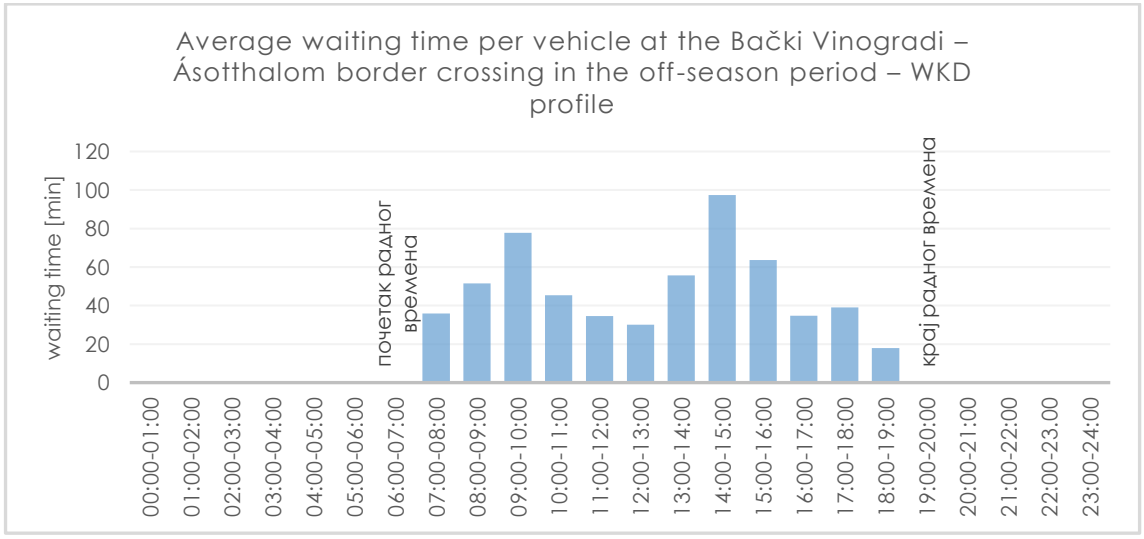


Figure 5-18 Average waiting time per vehicle at the Bački Vinogradi – Ásotthalom border crossing in the off-season period – WKD profile

Processing of the data for the WD season profile determined a daily hourly mean of μ=66.9 min, with a high standard deviation of σ=27.1. The minimum observed waiting time is 34.7 min

and occurs during 17:00–18:00, while the maximum observed waiting time is 118.3 min and occurs during 09:00–10:00. The dominant time window is the morning (06–12) (≈89.3 min). Based on the μ+σ threshold, the most pronounced peak hours are 09:00–10:00 (118.3 min), 11:00–12:00 (105.0 min), 10:00–11:00 (99.3 min). On weekend days during the season (WKD season profile), the daily hourly mean is μ=91.5 min, with a high standard deviation of σ=42.1 indicating significant within-day variability of waiting times. The minimum observed waiting time is 34.1 min and occurs during 18:00–19:00. The maximum observed waiting time is 174.3 min and occurs during 09:00–10:00. The dominant time window is the morning (06–12) (≈120.0 min). Based on the μ+σ threshold, the most pronounced peak hours are 09:00–10:00 (174.3 min), 11:00–12:00 (159.5 min).

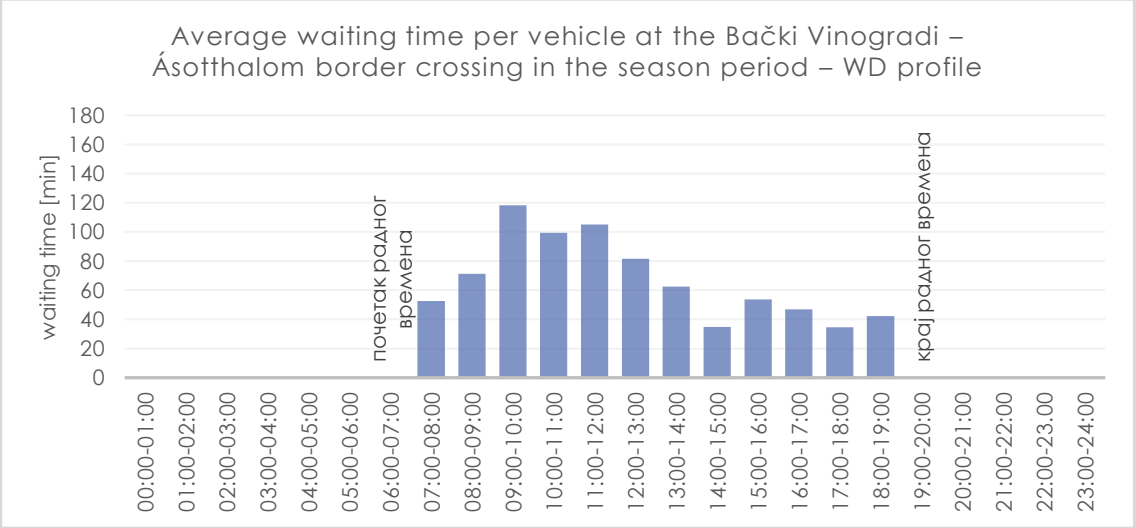


Figure 5-19 Average waiting time per vehicle at the Bački Vinogradi – Ásotthalom border crossing in the season period – WD profile

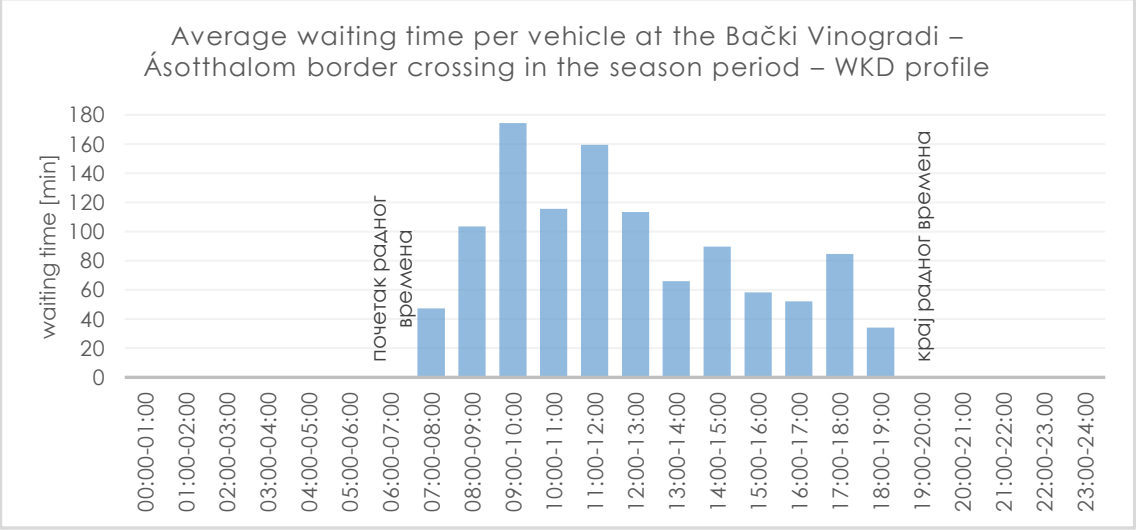


Figure 5-20 Average waiting time per vehicle at the Bački Vinogradi – Ásotthalom border crossing in the season period – WKD profile

In the comparative analysis of the season and off-season periods for the WD profile, the difference is μ_season − μ_off-season = +47.7 min (+248%), with the peak hour shifted (07:00–08:00 → 09:00–10:00). For the seasonal WKD profile, the difference is μ_season − μ_off-season = +42.9 min (+88%), with the peak hour shifted (14:00–15:00 → 09:00–10:00).

## 5.6. Horgoš – Röszke Border Crossing

Processing of the data for the Horgoš border crossing, for the WD off-season profile, determined a daily hourly mean of μ=31.7 min, with a standard deviation of σ=12.9. The minimum observed waiting time is 15.7 min and occurs during 03:00–04:00, while the maximum observed waiting time is 68.8 min and occurs during 14:00–15:00. The dominant time window is the afternoon (12–18) (≈45.8 min). Based on the μ+σ threshold, the most pronounced peak hours are: 14:00–15:00 (68.8 min), 13:00–14:00 (55.7 min), 11:00–12:00 (48.9 min). For the WKD off-season profile, a daily hourly mean of μ=36.6 min was determined, with a standard deviation of σ=14.7. The minimum observed waiting time is 21.0 min and occurs during 03:00–04:00, while the maximum observed waiting time is 75.0 min and occurs during 14:00–15:00. The dominant time window is the afternoon (12–18) (≈55.0 min). Based on the μ+σ threshold, the most pronounced peak hours are: 14:00–15:00 (75.0 min), 15:00–16:00 (71.2 min), 11:00–12:00 (53.9 min), 12:00–13:00 (53.6 min).

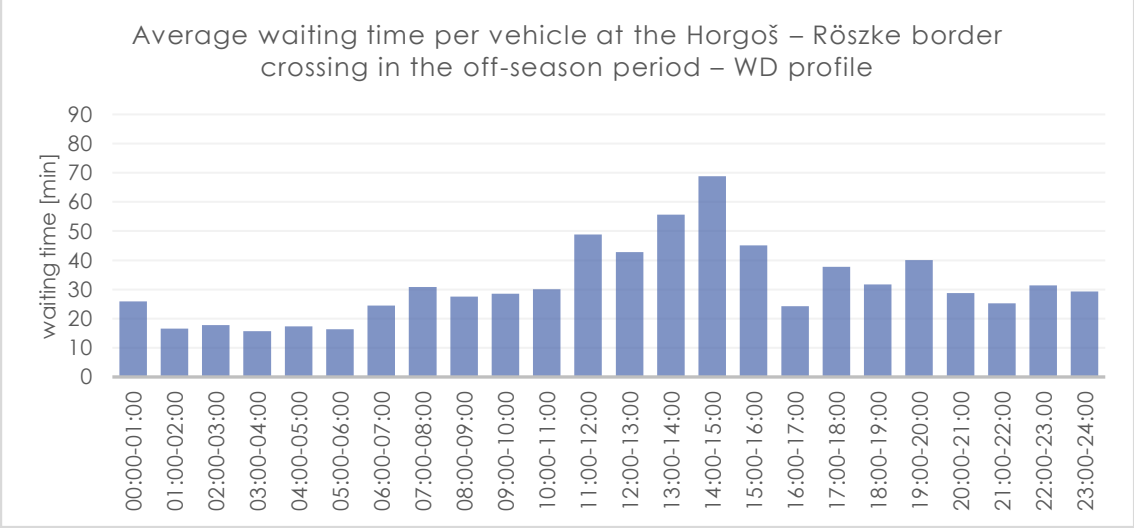


Figure 5-21 Average waiting time per vehicle at the Horgoš – Röszke border crossing in the off-season period – WD profile

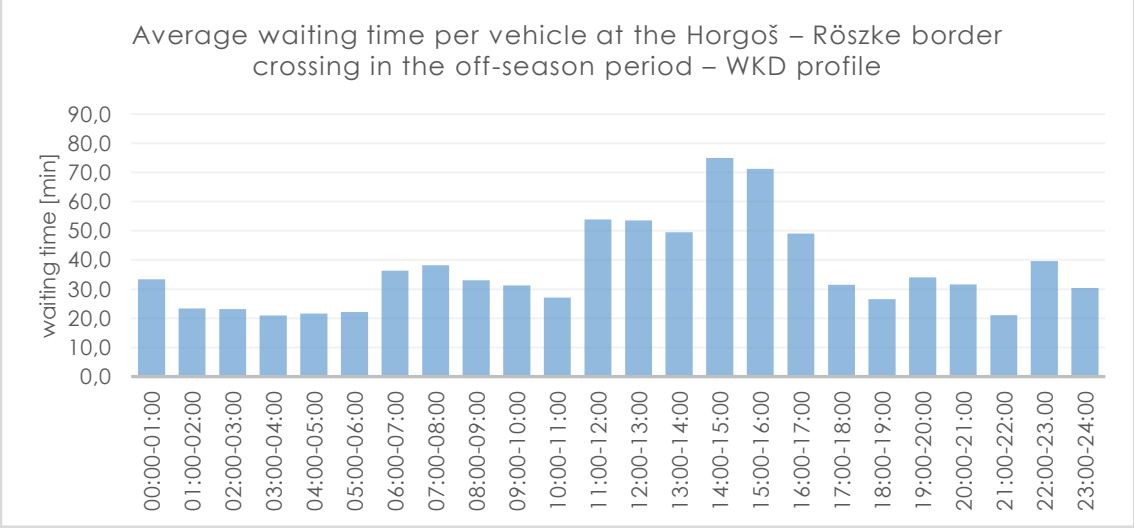


Figure 5-22 Average waiting time per vehicle at the Horgoš – Röszke border crossing in the off-season period – WKD profile

Processing of the data for the Horgoš border crossing, for the WD season profile, determined a daily hourly mean of μ=66.1 min, with a standard deviation of σ=36.0. The minimum observed

waiting time is 15.8 min and occurs during 22:00–23:00. The maximum observed waiting time is 171.6 min and occurs during 05:00–06:00. The dominant time window is the night (00–06) (≈101.3 min). Based on the μ+σ threshold, the most pronounced peak hours are: 05:00–06:00 (171.6 min), 04:00–05:00 (145.0 min). For the weekend period, i.e., the WKD season profile, the daily hourly mean is μ=79.4 min, with a standard deviation of σ=43.1. The minimum observed waiting time is 17.0 min and occurs during 22:00–23:00, while the maximum observed waiting time is 193.4 min and occurs during 04:00–05:00. The dominant time window is the night (00–06) (≈115.9 min). Based on the μ+σ threshold, the most pronounced peak hours are: 04:00–05:00 (193.4 min), 05:00–06:00 (176.5 min).

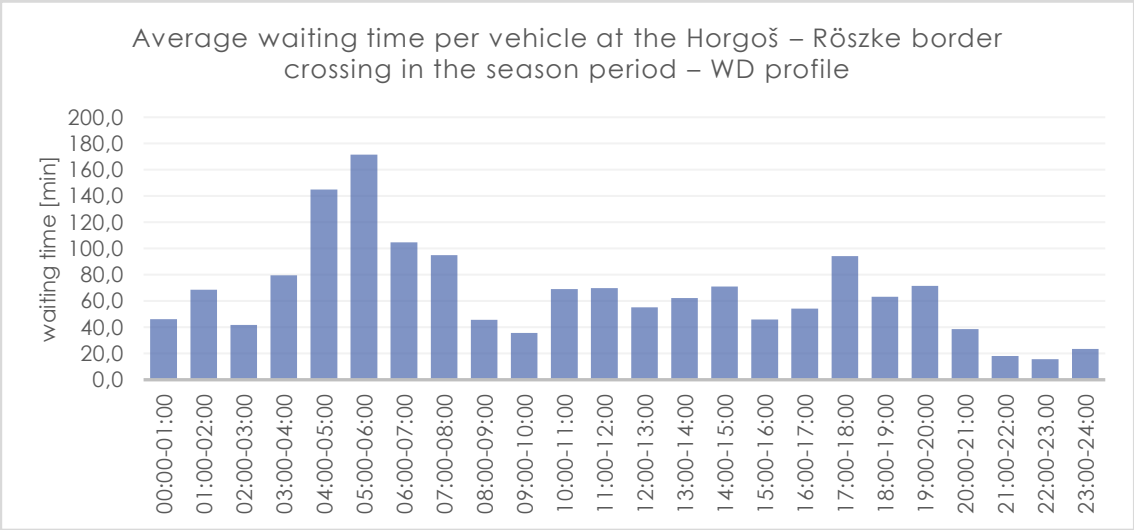


Figure 5-23 Average waiting time per vehicle at the Horgoš – Röszke border crossing in the season period – WD profile

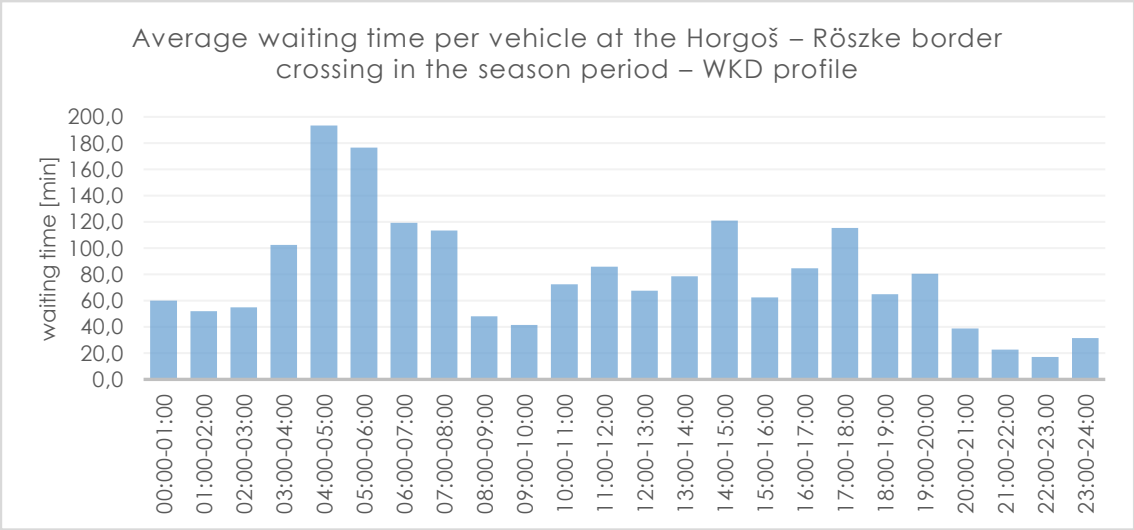


Figure 5-24 Average waiting time per vehicle at the Horgoš – Röszke border crossing in the season period – WKD profile

In the comparative analysis of the season and off-season periods for the WD profile, μ_season − μ_off-season = +37.3 min (+117%), with the peak hour shifted (14:00–15:00 → 05:00–06:00). In the WKD season profile, the difference is μ_season − μ_off-season = +46.5 min (+127%), with the peak hour shifted (14:00–15:00 → 04:00–05:00).

## 5.7. Horgoš 2 – Röszke Border Crossing

Processing of the data for the Horgoš 2 border crossing, for the WD off-season profile, determined a daily hourly mean of μ=37.9 min, with a standard deviation of σ=23.3. The minimum observed waiting time is 9.6 min and occurs during 22:00–23:00, while the maximum observed waiting time is 97.2 min and occurs during 15:00–16:00. The dominant time window is the afternoon (12–18) (≈66.3 min). Based on the μ+σ threshold, the most pronounced peak hours are: 15:00–16:00 (97.2 min), 14:00–15:00 (86.1 min), 16:00–17:00 (72.3 min). For the WKD off-season profile, a daily hourly mean of μ=47.8 min was determined, with a standard deviation of σ=27.0. The minimum observed waiting time is 9.4 min and occurs during 22:00–23:00, while the maximum observed waiting time is 101.8 min and occurs during 15:00–16:00. The dominant time window is the afternoon (12–18) (≈84.1 min). Based on the μ+σ threshold, the most pronounced peak hours are: 15:00–16:00 (101.8 min), 14:00–15:00 (97.6 min), 13:00–14:00 (81.4 min), 17:00–18:00 (80.4 min).

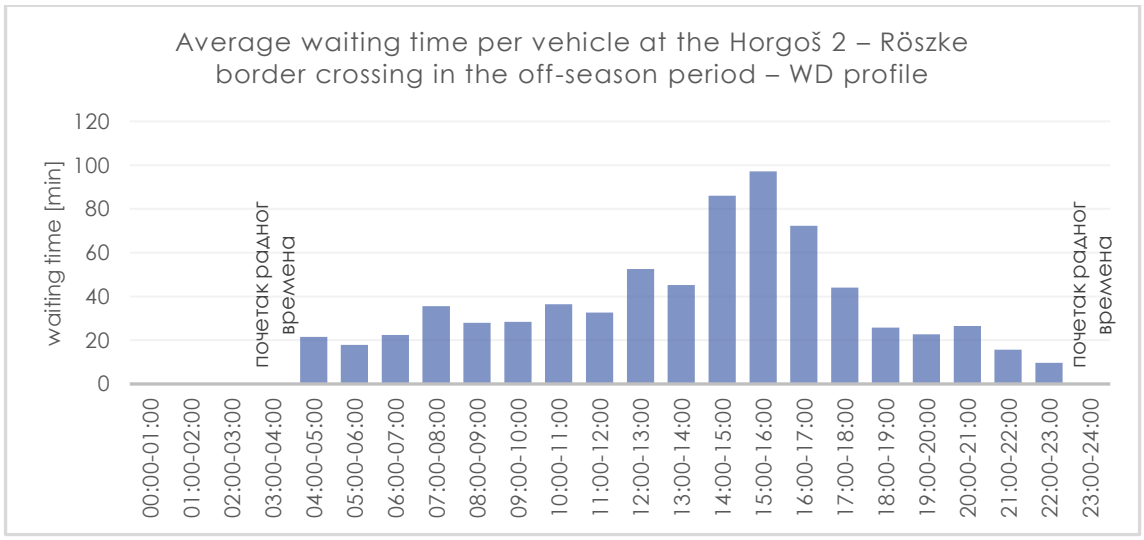


Figure 5-25 Average waiting time per vehicle at the Horgoš 2 – Röszke border crossing in the off-season period – WD profile

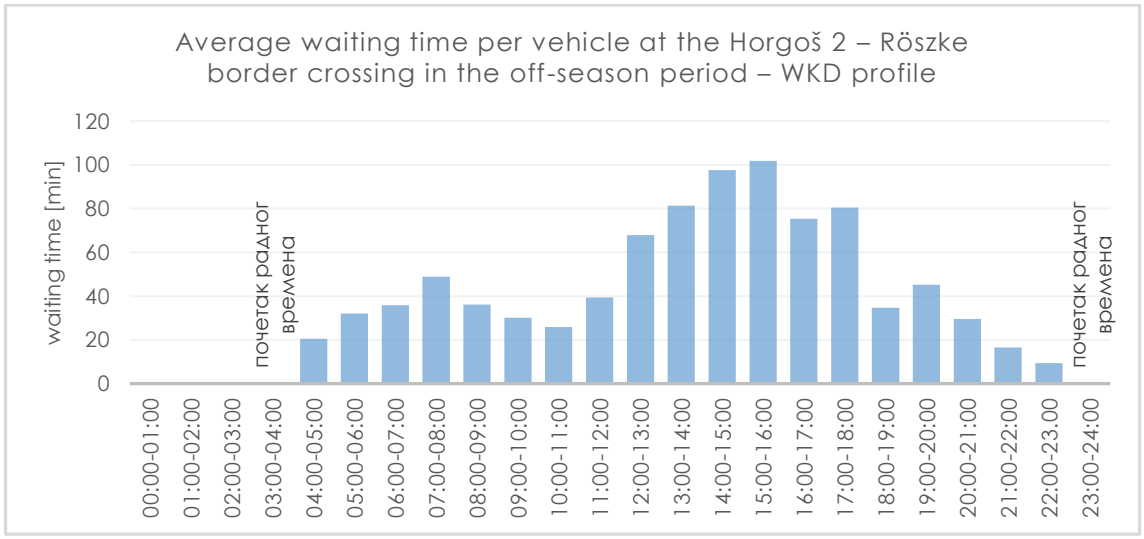


Figure 5-26 Average waiting time per vehicle at the Horgoš 2 – Röszke border crossing in the off-season period – WKD profile

Processing of the data for the seasonal period, for the WD season profile, determined a daily hourly mean of μ=66.6 min, with a standard deviation of σ=37.0. The minimum observed

waiting time is 17.1 min and occurs during 22:00–23:00, while the maximum observed waiting time is 163.6 min and occurs during 06:00–07:00. The dominant time window is the afternoon (12–18) (≈78.5 min). Based on the μ+σ threshold, the most pronounced peak hours are: 06:00–07:00 (163.6 min), 14:00–15:00 (137.4 min). For WKD during the season, the daily hourly mean is μ=78.7 min, with a standard deviation of σ=35.9. The minimum observed waiting time is 15.0 min and occurs during 22:00–23:00, while the maximum observed waiting time is 166.7 min and occurs during 14:00–15:00. The dominant time window is the afternoon (12–18) (≈110.4 min). Based on the μ+σ threshold, the most pronounced peak hours are: 14:00–15:00 (166.7 min), 16:00–17:00 (120.0 min).

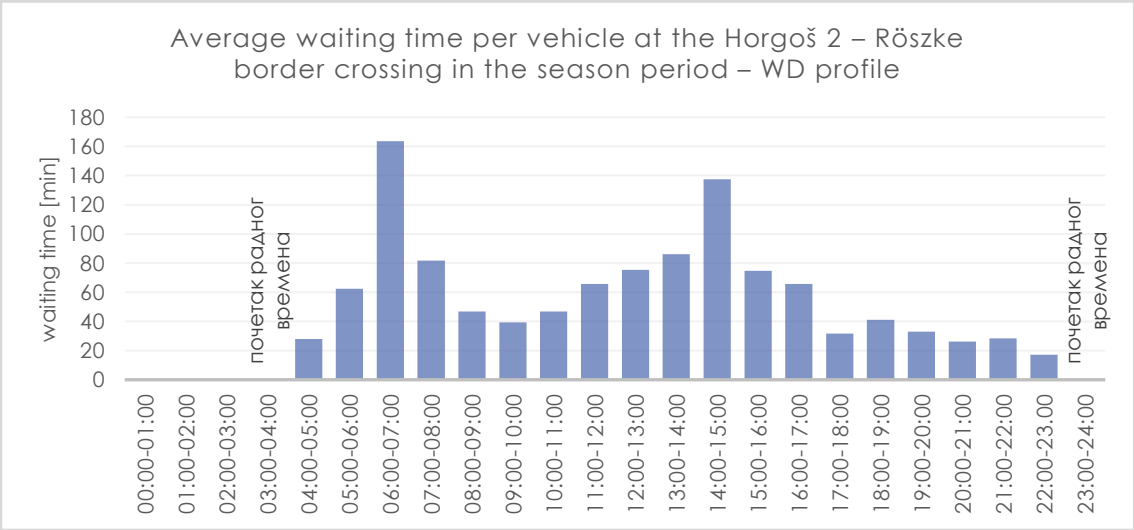


Figure 5-27 Average waiting time per vehicle at the Horgoš 2 – Röszke border crossing in the season period – WD profile

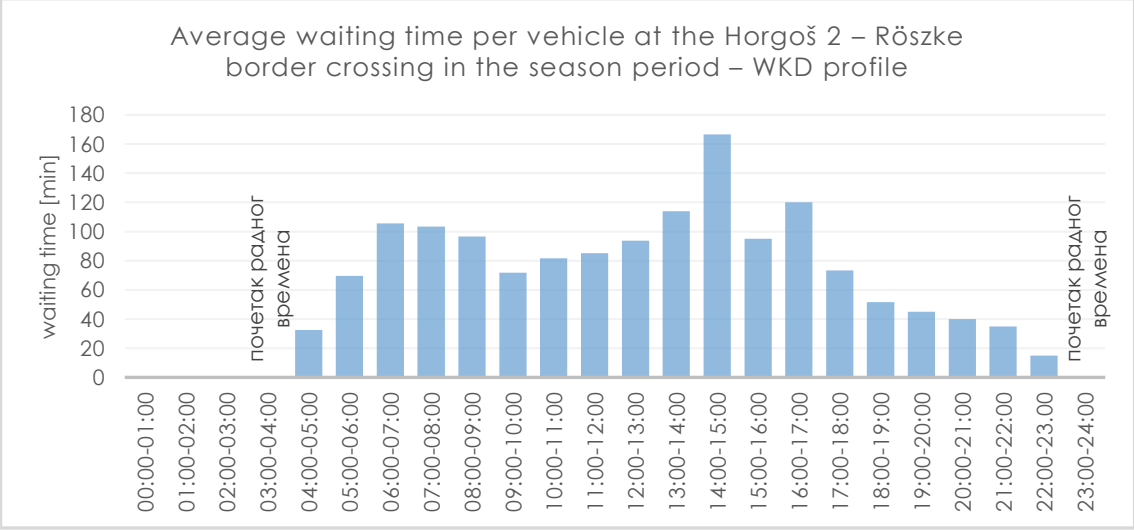


Figure 5-28 Average waiting time per vehicle at the Horgoš 2 – Röszke border crossing in the season period – WKD profile

In the comparative analysis of the season and off-season periods for the WD profile, μ_season − μ_off-season = +23.5 min (+60%), with the peak hour shifted (15:00–16:00 → 06:00–07:00). In the WKD season profile, the difference is μ_season − μ_off-season = +32.4 min (+65%), with the peak hour shifted (15:00–16:00 → 14:00–15:00).

## 5.8. Đala – Tiszasziget Border Crossing

Processing of the data for the Đala border crossing, for the working day in the off-season, determined a daily hourly mean of μ=9.4 min, with a standard deviation of σ=1.5. The minimum observed waiting time is 7.1 min and occurs during 18:00–19:00, while the maximum waiting time is 12.6 min and occurs during 08:00–09:00. The dominant time window is the morning (06–12) (≈10.1 min). Based on the μ+σ threshold, the most pronounced peak hours are: 08:00–09:00 (12.6 min), 09:00–10:00 (11.7 min). For the WKD off-season profile, the daily hourly mean is μ=18.6 min, with a standard deviation of σ=4.8. The minimum observed waiting time is 10.6 min and occurs during 18:00–19:00. The maximum observed waiting time is 25.6 min and occurs during 12:00–13:00. The dominant time window is the afternoon (12–18) (≈21.9 min). Based on the μ+σ threshold, the most pronounced peak hours are 12:00–13:00 (25.6 min), 14:00–15:00 (25.4 min).

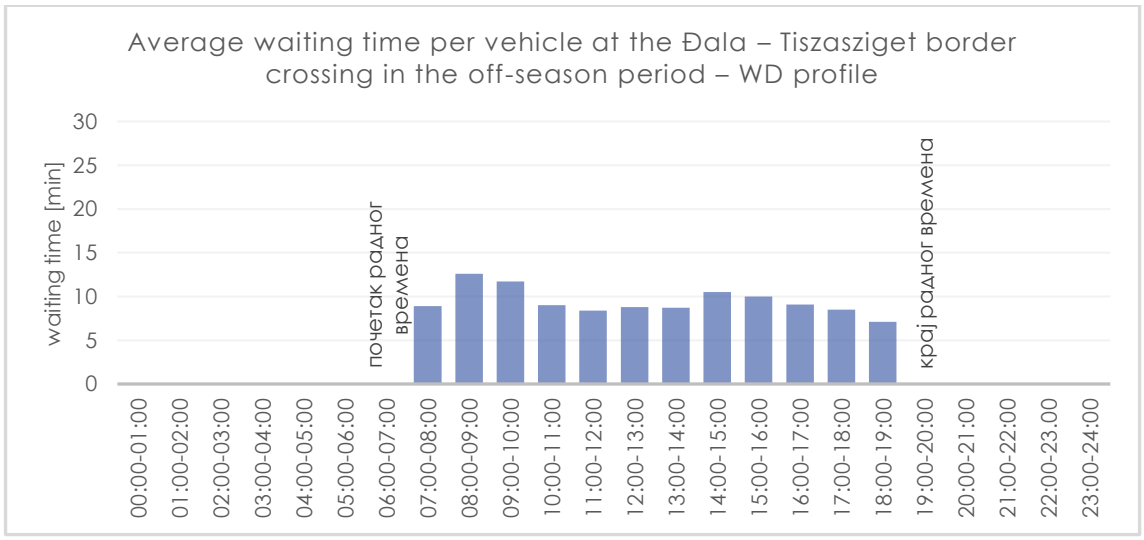


Figure 5-29 Average waiting time per vehicle at the Đala – Tiszasziget border crossing in the off-season period – WD profile

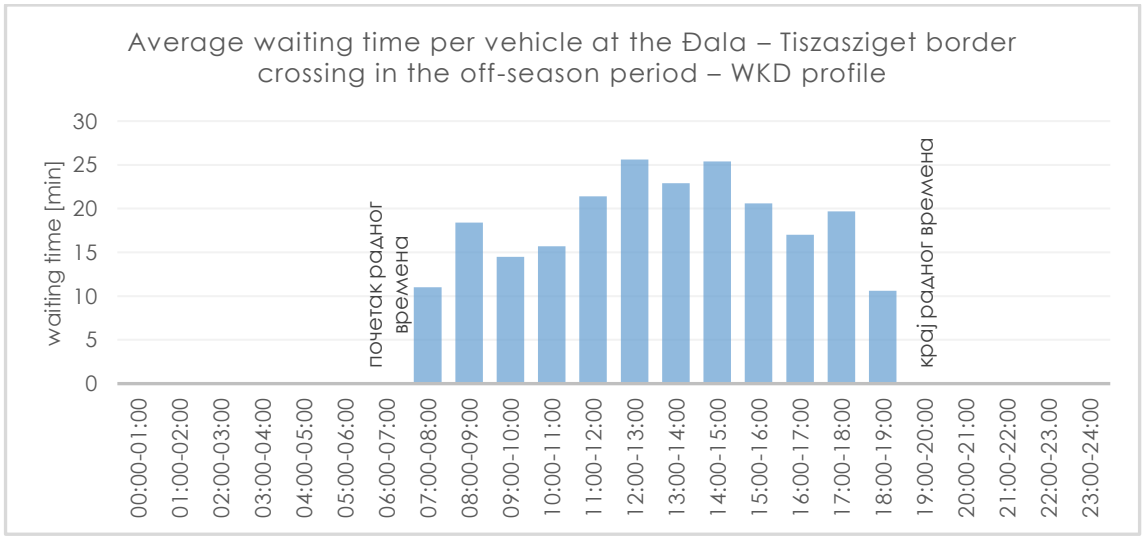


Figure 5-30 Average waiting time per vehicle at the Đala – Tiszasziget border crossing in the off-season period – WKD profile

For the WD season profile at this border crossing, a daily hourly mean of μ=15.9 min was determined, with a standard deviation of σ=6.9. The minimum observed waiting time is 3.6 min and occurs during 07:00–08:00. The maximum observed waiting time is 28.4 min and occurs during 13:00–14:00. The dominant time window is the afternoon (12–18) (≈17.8 min). Based on

the μ+σ threshold, the most pronounced peak hours are: 13:00–14:00 (28.4 min), 14:00–15:00 (27.5 min). On weekends during the season, i.e., for the WKD season profile, the daily hourly mean is μ=29.3 min, with a standard deviation of σ=10.3. The minimum observed waiting time is 7.0 min and occurs during 07:00–08:00, while the maximum observed waiting time is 42.5 min and occurs during 12:00–13:00. The dominant time window is the afternoon (12–18) (≈32.6 min). Based on the μ+σ threshold, the most pronounced peak hours are: 12:00–13:00 (42.5 min), 13:00–14:00 (41.5 min), 11:00–12:00 (40.3 min), 14:00–15:00 (40.3 min).

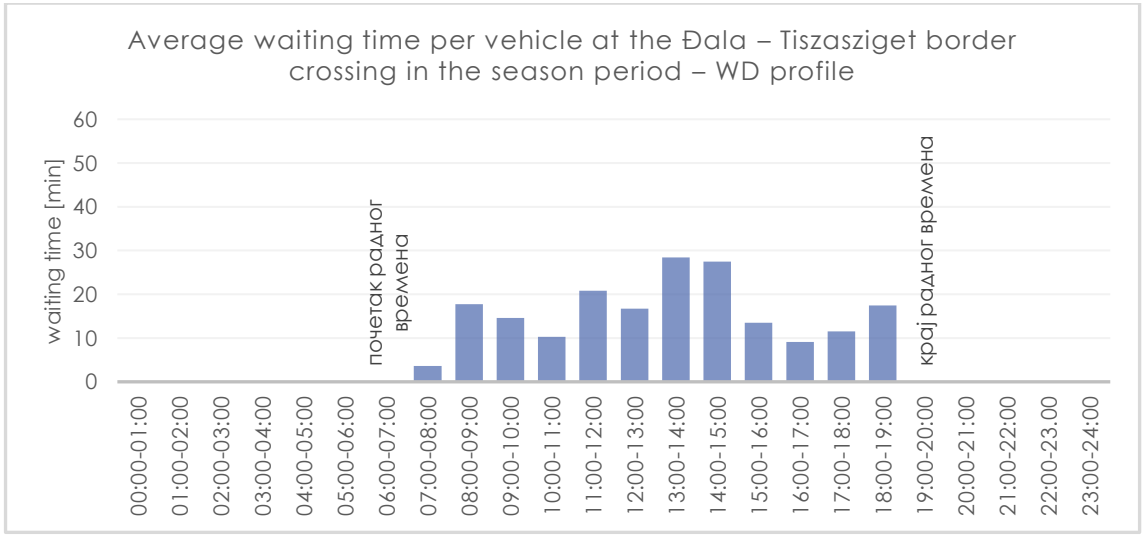


Figure 5-31 Average waiting time per vehicle at the Đala – Tiszasziget border crossing in the season period – WD profile

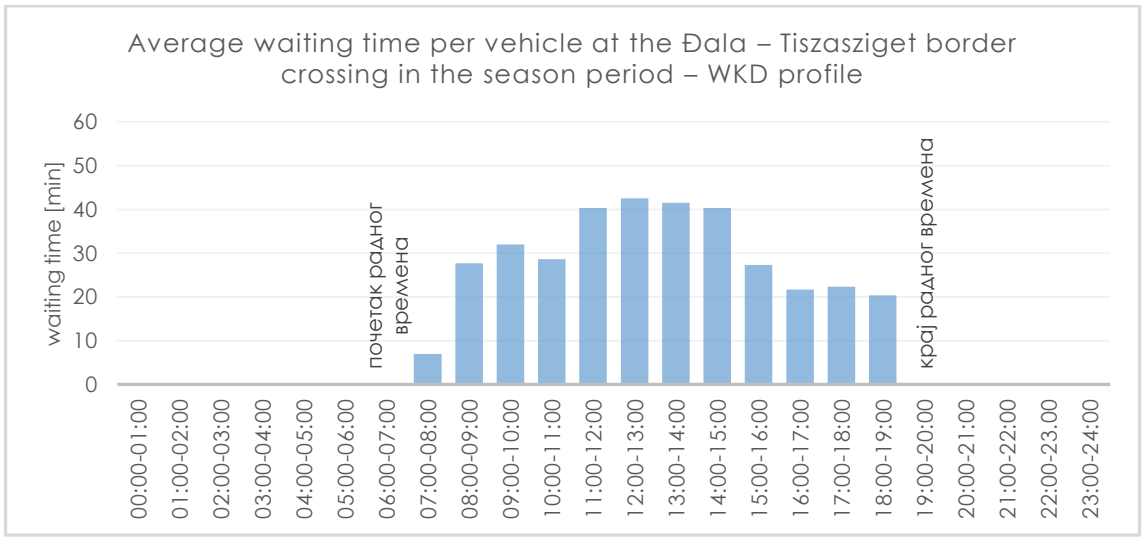


Figure 5-32 Average waiting time per vehicle at the Đala – Tiszasziget border crossing in the season period – WKD profile

In the comparative analysis of the season and off-season periods for the WD profile, μ_season − μ_off-season = +6.5 min (+69%), with the peak hour shifted (08:00–09:00 → 13:00–14:00). In the WKD season profile, the difference is μ_season − μ_off-season = +10.7 min (+58%), with the peak hour unchanged (12:00–13:00).

## 5.9. Rabe – Kübekháza Border Crossing

Processing of the data for the Rabe border crossing, for the WD off-season profile, determined a daily hourly mean of μ=5.6 min, with a standard deviation of σ=2.0. The minimum observed waiting time is 3.5 min and occurs during 07:00–08:00, while the maximum observed waiting time is 11.0 min and occurs during 11:00–12:00. The dominant time window is the morning (06–12) (≈6.5 min). Based on the μ+σ threshold, the most pronounced peak hours are 11:00–12:00 (11.0 min), 10:00–11:00 (7.7 min). For the WKD off-season profile, the daily hourly mean is μ=12.4 min, with a standard deviation of σ=8.2. The minimum observed waiting time is 5.5 min and occurs during 07:00–08:00. The maximum observed waiting time is 35.6 min and occurs during 16:00–17:00. The dominant time window is the afternoon (12–18) (≈17.1 min). Based on the μ+σ threshold, the most pronounced peak hours are 16:00–17:00 (35.6 min), 17:00–18:00 (20.7 min).

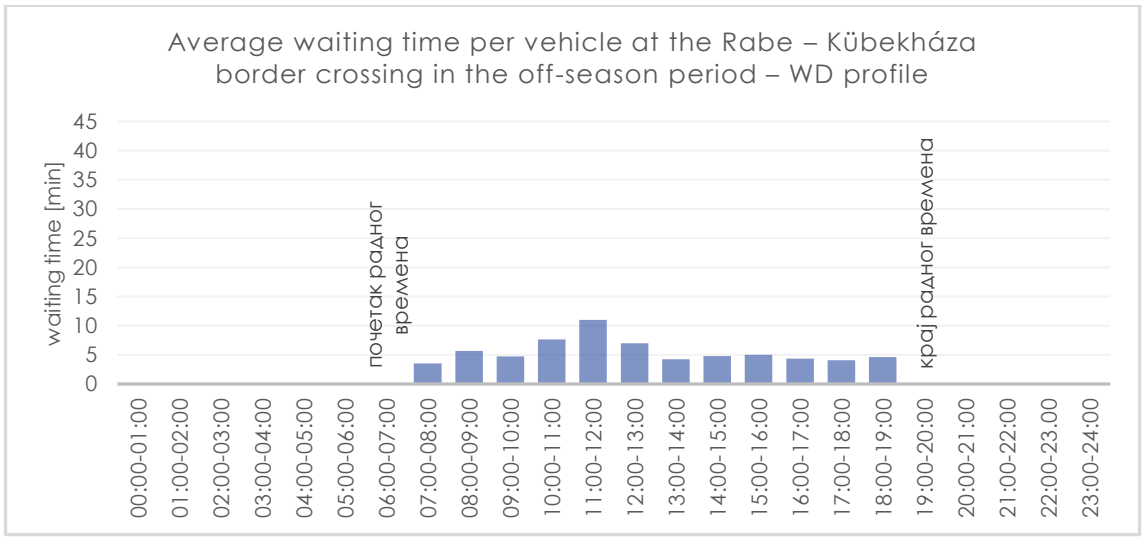


Figure 5-33 Average waiting time per vehicle at the Rabe – Kübekháza border crossing in the off-season period – WD profile

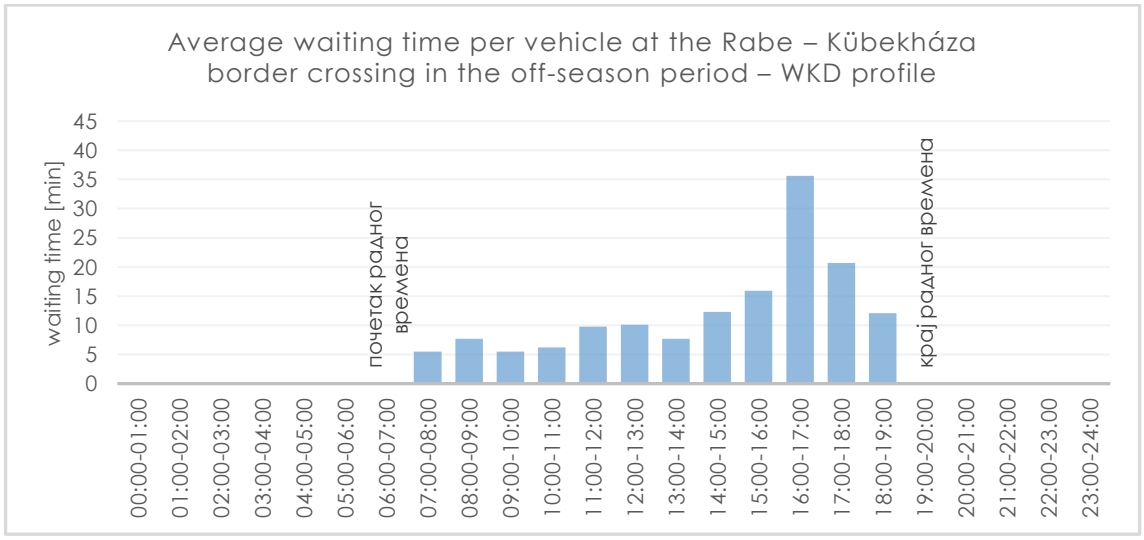


Figure 5-34 Average waiting time per vehicle at the Rabe – Kübekháza border crossing in the off-season period – WKD profile

During the seasonal period at the Rabe border crossing, for the WD season profile a daily hourly mean of μ=7.2 min was determined, with a standard deviation of σ=2.3. The minimum observed waiting time is 4.2 min and occurs during 18:00–19:00. The maximum observed waiting time is 12.1 min and occurs during 11:00–12:00. The dominant time window is the

morning (06–12) (≈7.8 min). Based on the μ+σ threshold, the most pronounced peak hours are 11:00–12:00 (12.1 min), 12:00–13:00 (10.6 min). For the WKD season profile, the daily hourly mean is μ=26.1 min, with a standard deviation of σ=12.5. The minimum observed waiting time is 13.3 min and occurs during 07:00–08:00, while the maximum waiting time is 52.0 min and occurs during 14:00–15:00. The dominant time window is the afternoon (12–18) (≈33.4 min). Based on the μ+σ threshold, the most pronounced peak hours are 14:00–15:00 (52.0 min), 13:00–14:00 (40.7 min), 12:00–13:00 (39.0 min).

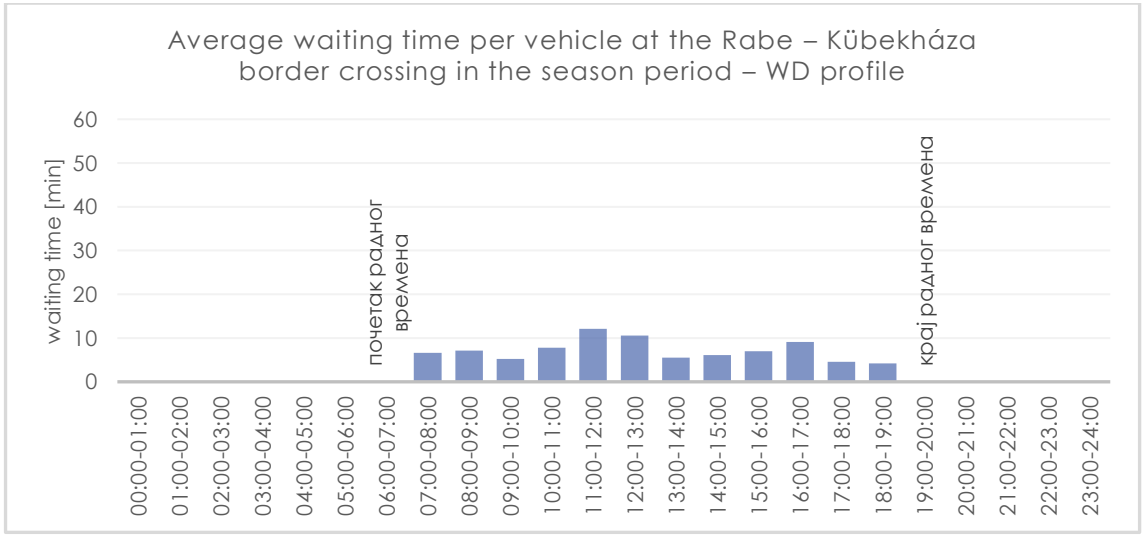


Figure 5-35 Average waiting time per vehicle at the Rabe – Kübekháza border crossing in the season period – WD profile

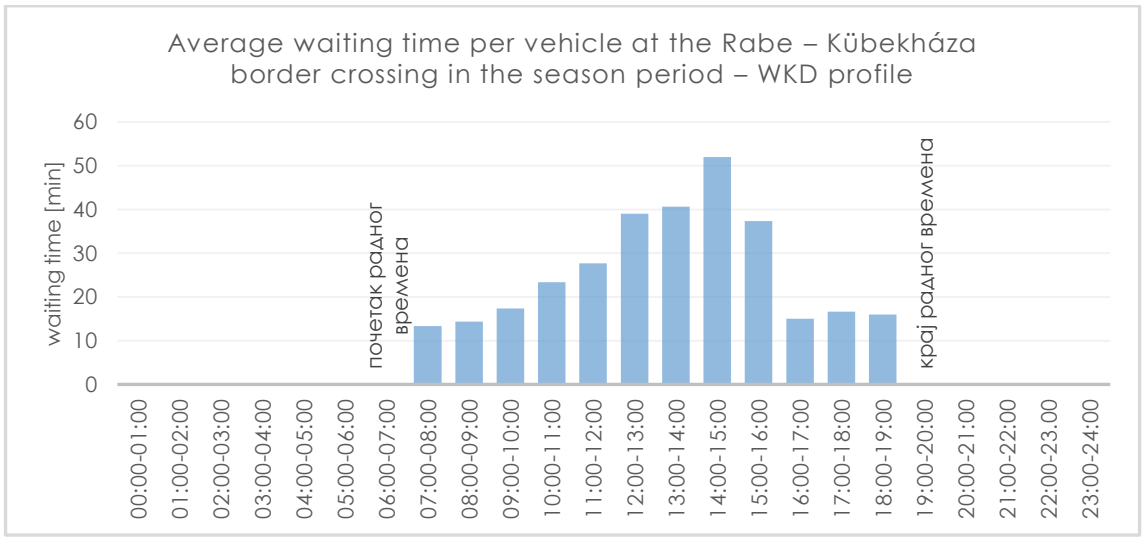


Figure 5-36 Average waiting time per vehicle at the Rabe – Kübekháza border crossing in the season period – WKD profile

In the comparative analysis of the season and off-season periods for the WD profile, μ_season − μ_off-season = +1.6 min (+29%), with the peak hour unchanged (11:00–12:00). In the WKD season profile, the difference is μ_season − μ_off-season = +13.6 min (+110%), with the peak hour shifted (16:00–17:00 → 14:00–15:00).

## 5.10. Assessment of Waiting Time at Border Crossings

For assessing waiting time at border crossings, thresholds of acceptable versus unacceptable waiting time were analysed from the user perspective, as well as from the perspective of defined operating norms at border crossings.

In the regulatory acts of the European Union there is no single, normatively prescribed numerical limit of "acceptable" waiting time for passenger cars at land border crossings. Instead, framework documents emphasise proportionality of measures, operational efficiency, and the possibility of reducing the level of control in extraordinary and unforeseen circumstances to avoid "excessive" waiting. This approach is clearly articulated in the EU Handbook for border guards [2], as well as in the Schengen Borders Code[3], where no specific waiting-time threshold is stated; rather, the focus is on capacity management and handling of exceptions to preserve optimal throughput of vehicles and passengers.

In the absence of a defined formal threshold of acceptable waiting time in EU countries, monitoring practice in Europe and in the Western Balkans region offers empirical benchmarks from the user perspective. The document of the Regional Cooperation Council on tourism policy (RCC)[4] records that the average waiting time for passengers in passenger cars amounted to around 30 minutes. Based on this parameter, it may be considered—within the context of user experience—that this is the expected waiting time under regular conditions. In addition, reports and bulletins of the Transport Community [5] [6] classify waiting time at border crossings into classes (<20 min; 20–40 min; 40–60 min; >60 min), which in practice may be accepted as guidance for conditions of waiting time for passengers and operators. These documents also show that in certain parts of the year (e.g., peak loads due to tourist migrations) waiting times can reach thresholds above 120 minutes, and extremes of several hours, which from the user perspective can objectively be regarded as unacceptable.

As an additional indicator of user "tolerance" at border crossings, benchmarks applied in other passenger transport sectors may serve for comparative analysis. In the Birmingham Airport performance report[7] it is stated that 95% of EEA/UK passengers are processed within 25 minutes, and 95% of non-EEA passengers within 45 minutes. It is important to note that the benchmark cited in this document is not applicable as a norm for road border crossings; however, it indicates that waiting times longer than 30–45 minutes in passenger flows may constitute unacceptable durations from the user perspective.

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[2] European Commission, Directorate-General for Migration and Home Affairs. (2022). Practical handbook for border guards (Schengen Handbook). European Commission. https://home-affairs.ec.europa.eu/system/files/2022-11/Practical%20handbook%20for%20border%20guards_en

[3] European Union. (2016/2024). Regulation (EU) 2016/399 of the European Parliament and of the Council of 9 March 2016 on a Union Code on the rules governing the movement of persons across borders (Schengen Borders Code) (consolidated version of 10 July 2024). EUR-Lex. https://eur-lex.europa.eu/eli/reg/2016/399/2024-07-10/eng

[4] Kennell, J., Chaperon, S., Šegota, T., & Morrison, A. (2020). Western Balkans tourism policy assessment with recommendations. Regional Cooperation Council & University of Greenwich. https://www.rcc.int/download/docs/Ref%201_Tourism%20Policy%20Assessment%20with%20Recommendations.pdf/fb7c2c820b58ee138933888458ea4096.pdf

[5] Transport Community. (2020, July). Waiting times at Western Balkans/EU Member States borders – Monthly statistical report (June 2020). Transport Community Secretariat. https://www.transport-community.org/wp-content/uploads/2020/07/Waiting-times-EU-WB6-June-2020.pdf

[6] Transport Community. (2021, June). Monitoring waiting time at Western Balkans/EU Member States borders – Monthly overview. Transport Community Secretariat. https://www.transport-community.org/covid-19/monitoring-waiting-time-at-western-balkans-eu-member-states-borders-june-2021/

[7] Independent Chief Inspector of Borders and Immigration. (2021, September). A short inspection of Border Force queue management at Birmingham Airport based upon onsite observations.. https://assets.publishing.service.gov.uk/media/61dd80858fa8f505953f4f03/A_short_inspection_of_Border_Force_queue_management_at_Birmingham_Airport_based_upon_onsite_observations__September_2021.pdf

To the present analysis, classes of waiting-time acceptability for passenger cars at the analyzed border crossings are defined according to user perception and monitoring practice in Europe. As the criterion for distributing border crossings by classes, the value of the sum of the mean (μ) and the standard deviation from the mean (σ), expressed in minutes, is adopted. It is important to emphasize that the presented classes are not normative standards, but analytical guides grounded in comparable regional sources and related contexts, formulated for the needs of the present analysis.

Table 5-1 Classes of waiting-time acceptability at border crossings

| Class | Criteria μ+σ (min) | User perception | State description |
|---|---|---|---|
| | ≤ 30 min | generally acceptable | for most of the day the expected waiting time at the border crossing is acceptable to users |
| | 30–60 min | marginally acceptable | operationally marked as increased load, with an expected rise in user dissatisfaction |
| | 60-120 min | unacceptable | service degradation and user dissatisfaction; zone for applying measures to reduce the level of passenger control |
| | > 120 min | extremely unacceptable | seasonal loads and pronounced short-term loads during public holidays; situations critical for control and the operation of border crossings |

In the following Tables, the waiting-time parameters are presented for each border crossing, namely: the minimum average hourly waiting time (Mt_1), the average hourly waiting time at the daily level or within the operating hours of the border crossing (μ), the standard deviation of the average hourly waiting time (σ), and the maximum average hourly waiting time (Mt_2). The class of a border crossing for a given profile is determined by the value of the sum of the mean (μ) and the standard deviation from the mean (σ).

Table 5-2 Summary presentation of waiting times at border crossings in the off-season period

| Border Crossing | Profil | Class | Off-season period | | | |
|---|---|---|---|---|---|---|
| | | | Mt_1 (min) | μ (min) | σ (min) | Mt_2 (min) |
| Bački Breg – Hercegszántó | WD | | 3,2 | 5,4 | 1,6 | 8,4 |
| | WKD | | 3,8 | 7,5 | 4,2 | 21,1 |
| Rastina – Bácsszentgyörgy | WD | | 3,0 | 5,9 | 2,7 | 13,6 |
| | WKD | | 4,0 | 9,7 | 6,8 | 24,7 |
| Bajmok – Bácsalmás | WD | | 5,2 | 7,0 | 1,5 | 9,8 |
| | WKD | | 5,0 | 15,5 | 6,4 | 24,1 |
| Kelebija – Tompa | WD | | 7,6 | 17,8 | 12,6 | 55,1 |
| | WKD | | 6,4 | 26,4 | 16,2 | 62,4 |
| Bački Vinogradi – Ásotthalom | WD | | 9,6 | 19,2 | 7,8 | 32,7 |
| | WKD | | 17,9 | 48,6 | 21,3 | 97,4 |
| Horgoš – Röszke | WD | | 15,7 | 31,7 | 12,9 | 68,8 |
| | WKD | | 21,0 | 36,6 | 14,7 | 75,0 |
| Horgoš 2 – Röszke | WD | | 9,6 | 37,9 | 23,3 | 97,2 |
| | WKD | | 9,4 | 47,8 | 27,0 | 101,8 |
| Đala – Tiszasziget | WD | | 7,1 | 9,4 | 1,5 | 12,6 |
| | WKD | | 10,6 | 18,6 | 4,8 | 25,6 |
| Rabe – Kübekháza | WD | | 3,5 | 5,6 | 2,0 | 11,0 |
| | WKD | | 5,5 | 12,4 | 8,2 | 35,6 |

Table 5-3 Summary presentation of waiting times at border crossings in the season period

| Border Crossing | Profil | Class | Season period | | | |
|---|---|---|---|---|---|---|
| | | | Mt_1 (min) | μ (мин) | σ (мин) | Mt_2 (мин) |
| Bački Breg – Hercegszántó | РД | | 3,5 | 8,7 | 4,2 | 19,3 |
| | ВКД | | 5,5 | 16,0 | 7,0 | 33,1 |
| Rastina – Bácsszentgyörgy | РД | | 8,1 | 11,7 | 3,4 | 20,1 |
| | ВКД | | 8,3 | 19,9 | 8,9 | 36,7 |
| Bajmok – Bácsalmás | РД | | 6,4 | 11,3 | 5,6 | 25,2 |
| | ВКД | | 16,7 | 26,8 | 7,6 | 42,3 |
| Kelebija – Tompa | РД | | 13,8 | 39,6 | 18,0 | 78,9 |
| | ВКД | | 21,2 | 44,5 | 15,8 | 76,3 |
| Bački Vinogradi – Ásotthalom | РД | | 34,7 | 66,9 | 27,1 | 118,3 |
| | ВКД | | 34,1 | 91,5 | 42,1 | 174,3 |
| Horgoš – Röszke | РД | | 15,8 | 66,1 | 36,0 | 171,6 |
| | ВКД | | 17,0 | 79,4 | 43,1 | 193,4 |
| Horgoš 2 – Röszke | РД | | 17,1 | 60,6 | 37,0 | 163,6 |
| | ВКД | | 15,0 | 78,7 | 35,9 | 166,7 |
| Đala – Tiszasziget | РД | | 3,6 | 15,9 | 6,9 | 28,4 |
| | ВКД | | 7,0 | 29,3 | 10,3 | 42,5 |
| Rabe – Kübekháza | РД | | 4,2 | 7,2 | 2,3 | 12,1 |
| | ВКД | | 13,3 | 26,1 | 12,5 | 52,0 |

# 6. CONCLUSION

Within this study, an analysis was conducted of vehicle and passenger traffic volumes, waiting times, and vehicle occupancy for outbound flows at all road border crossings between the Republic of Serbia and the Republic of Hungary. The analysis is based on a unified dataset that consolidates field measurements and institutional sources, as well as on the application of statistical descriptors and acceptability classes.

Analyzing the research results from the perspective of vehicle flows by months and by days, the findings show a stable and recognizable seasonal–weekly dynamic that consistently explains variations in waiting times and load distributions at all border crossings.

Taking into account the data from all border crossings, the observed monthly distribution clearly displays seasonal loading. In the off-season (winter and early spring months), the vehicle flow is lower and more stable, with shorter, locally conditioned oscillations that are largely a consequence of holiday periods. From late spring, a gradual increase in demand for flow is observed, which rises explicitly in the summer months due to tourist migrations and transit travel. These monthly extremes are precisely correlated with the systematic rise in average hourly waiting-time values and the widening range of standard deviation. These patterns are particularly pronounced at the primary crossings. After the peak in the summer period, a gradual rebalancing of daily traffic volume occurs in the autumn months. At the end of the year, short but intense rebounds of flow are observed that can be dated to holiday travel (Christmas and New Year). These flow changes are coherent across crossings, but the amplitude is most pronounced at the primary ones (Bački Breg – Hercegszántó, Kelebija – Tompa, Horgoš – Röszke), then at the secondary ones (Bajmok – Bácsalmás, Horgoš 2 – Röszke, Bački Vinogradi – Ásotthalom), while at the local crossings (Rastina – Bácsszentgyörgy, Đala – Tiszasziget, Rabe – Kübekháza) a more moderate, yet clear seasonal increase is present.

The distribution by days shows a clear weekend effect. The Monday–Thursday period represents the baseline days of traffic load, with more stable hourly profiles and lower deviations from the mean. During the season, Friday afternoons record an accumulation of weekend demand, while Saturday is in most cases the day with the highest flow. In the off-season, intra-weekly unevenness of flow is less intense than in the season, but remains measurable. In this case, the unevenness is particularly pronounced at secondary crossings, which absorb part of the passenger routes from tourist centres over the weekend.

The key implication is that weekend peak hours occur within shorter time windows which, together with a simultaneous increase in average vehicle occupancy (3+ passengers), leads to a disproportionate rise in the number of passengers in the system relative to the number of vehicles. Such temporal characteristics generate an increase in the average waiting time as well as a widening of the standard deviation, and the emergence of local "bottlenecks."

Vehicle occupancy (number of passengers per vehicle) in the observed periods is dominated by the 1–2 passenger range at most crossings on working days, with a noticeable increase to 3 or more passengers on weekends and in the season. This pattern is typical of recreational and tourist travel and indicates increased demand for passenger throughput. The increase in passenger throughput further affects the service time (passport control), which—along with the increased number of vehicles on weekends and during the season—additionally raises the average waiting time at border crossings.

Based on the analysis of waiting times at the observed border crossings, an increase in waiting time is evident at all crossings in the season compared to the off-season, more pronounced on weekends than on working days. The largest diference are observed at the primary border crossings (Horgoš – Röszke, Kelebija – Tompa) and at certain secondary crossings (Horgoš 2 – Röszke, Bački Vinogradi – Ásotthalom). Considering the overall situation and all crossings, it can be stated that the afternoon time blocks (≈06–18) are the most loaded, while the night hours (≈00–06) are the most favorable, with exceptions during certain seasonal waves (e.g., Horgoš). According to the adopted acceptability classes (≤30 acceptable; 30–60 marginally acceptable; 60–120 unacceptable; >120 extremely unacceptable), the highest tiers (60–120 and >120) occur in the season at Horgoš, Bački Vinogradi, Horgoš 2, and partly at Kelebija and Bajmok (WKD).

Observing individual border crossings, the following results related to average waiting times can be stated:

- Bački Breg – Hercegszántó (primary)
  - Off-season: low waiting times (μ+σ ≈ 7–12 min) and stable diurnal patterns; WKD > WD, but within the acceptable range.
  - Season: increase in μ, but μ+σ still largely "acceptable". Peak periods are most often in the afternoon (14–16h).
- Rastina – Bácsszentgyörgy (local)
  - Off-season: moderate to low waiting times.
  - Season: seasonal growth is moderate (WD μ+σ ≈ 15 min; WKD μ+σ ≈ 29–30 min on the boundary of acceptable). Peak periods remain stable in the afternoon; weekends have higher waiting times.
- Bajmok – Bácsalmás (secondary)
  - Off-season: WD acceptable; WKD acceptable/lower-mid values.
  - Season: WD remains acceptable, but WKD moves into "marginally acceptable" (μ+σ ≈ 34 min), with the peak hour shifting toward midday (12–13h).
- Kelebija – Tompa (primary)
  - Off-season: already "marginal" on WD (μ+σ ≈ 30–45 min), WKD also marginal.
  - Season: WD remains marginal, while WKD enters "unacceptable" (μ+σ ≈ 60+ min), with pronounced peak periods 11–16h.
- Bački Vinogradi – Ásotthalom (secondary)
  - Off-season: WD acceptable; WKD already unacceptable (μ+σ ≈ 70 min).
  - Season: WD unacceptable (≈94 min), WKD extremely unacceptable (μ+σ ≈ 134 min), with clear morning peaks (09–12h).
- Horgoš – Röszke (primary, motorway)
  - Off-season: marginal on both working days and weekends (WD/WKD μ+σ ≈ 45–51 min).
  - Season: WD unacceptable (≈102 min), WKD extremely unacceptable (≈123 min), with the peak hour shifting toward early morning/night during summer waves (04–06h). This is the system's "upper bound" of load.
- Horgoš 2 – Röszke (secondary)
  - Off-season: in the unacceptable class (μ+σ ≈ 61–75 min), with a peak load at 15–16h.
  - Season: unacceptable on WD (≈98 min) and WKD (≈115 min), with peak periods 06–07h and 14–16h.
- Đala – Tiszasziget (local)
  - Off-season: both categories acceptable (WD μ+σ ≈ 11 min; WKD ≈ 23–22 min), clear peak load in 08–10h (WD) and 12–15h (WKD).
  - Season: WD remains acceptable; WKD moves into "marginal" (μ+σ ≈ 39–40 min).
- Rabe – Kübekháza (local)
  - Off-season: low loads (both profiles acceptable).

- Season: WD still acceptable; WKD marginal (μ+σ ≈ 39 min), with an afternoon peak period 12–15h.

Finally, it should be borne in mind that the presented indicators are derived from the systematic processing of hourly averages and that, under operational conditions, deviations may occur due to factors outside the scope of this analysis (uneven arrivals, staffing and ICT capacities, exceptional control procedures, weather conditions, etc.). This limitation is explicitly stated in the report and does not diminish the value of the results as a reliable "snapshot of the state" and a basis for operational planning of demand/capacity management measures and coordination with neighbouring operators.