

LOW HELICOPTER FLIGHT INTRSECTION WITH PUBLIC ROAD NETWORK

Petar Miroslavljević¹, Delibor Pešić², Radomir Mijailović³, Miloš Marina⁴

Abstract: In the city congested area there is an increasing trend of involving helicopters and helicopter flights for police, military and civilian needs. First of all, there is a trends of panoramic flight and flight for the medical transport of patients. A special aspect is the helicopter transport of passengers in road traffic who have suffered accidents on road and experience injuries dangerous to life. Helidrome as the aviation infrastructure element contain approach and take off surface that extend from the edge of the helidrome Safety Area to reach 152m altitude above the ground. Approach and take off surface in the helicopters located in the city congested area pass through road traffic routes of different rank. The paper identifies a problem that is not adequately addressed and solved which is crossing of the helicopter airway and physically constructed roads. In domestic and foreign regulations, there is no relevant solution for adequately informing of road users and air traffic user about the crossing of these two types of traffic, which can endanger the safety of road and air traffic and cause damage to third parties. The aim of the paper is to encourage the processes and involve road signs for public road which inform users of roads of presence transport helicopters in low flight.

Keywords: helicopter, helidrome, road, intersection

1. INTRODUCTION

In the last ten years, helicopter traffic for civilian, police and military purposes has increased many times in countries in the region of Southeast Europe. In particular, the economic and social stability of the region has contributed to this following the turbulent changes of the 1990s. A special element that has contributed to this status of development of helicopter traffic is the development of heliports as infrastructural traffic elements of air traffic. The inclusion of heliports on the ground and at facilities and for specific purposes as transportation for mid-medical purposes has led to the construction of a heliport near Hospitals and Clinical Centers. The whole process of developing helicopter traffic in the city center is not accompanied by regulations and campaigns explaining the consequences and ways of articulating and controlling the safety of road and air traffic and transport intersections.

The regulation used to design heliports is basically derived from ICAO An14 Vol 2. Recently, aviation regulators have issued their own regulations and regulations for helicopter design:

- Civil Aviation Directorate of the Republic of Serbia, Rulebook on Conditions and Procedure for Issuing a Permit for the Use of a Helicopter (“RS Official Gazette”, No. 103/18) Directorate for Civil Aviation of Bosnia and Herzegovina (BHDCA), Rulebook on Airfields (“BiH Official Gazette”, No: 85/13
- Civil Aviation Agency of Montenegro, Rulebook on Criteria and Standards for the Smooth Use of Operational Surfaces, Facilities, Devices and Equipment at Helicopters (Official Gazette of Montenegro 9/2015)

In addition, even the laws in the field of road transport do not address the problem of intersection of air traffic of helicopters and road traffic. This is specifically meant by:

- Roads Act
- Rulebook on Traffic Signaling and
- Road Traffic Safety Law.

1 Phd, Patar Miroslavljević, M.Sc. Traffic Eng, B.Sc. Traffic Eng, Associated Professor, The Faculty and Transport and Traffic Engineering, Belgrade University, perami@sf.bg.ac.rs

2 Phd, Dalibor Pešić, M.Sc. Traffic Eng, B.Sc. Traffic Eng, Associated Professor, The Faculty and Transport and Traffic Engineering, Belgrade University, d.pesic@sf.bg.ac.rs

3 Phd, Radomir Mijailović, M.Sc. Mech Eng, B.Sc. Full Professor, The Faculty and Transport and Traffic Engineering, Belgrade University, radomirm@sf.bg.ac.rs

4 Miloš Marina B Sc. Traffic Eng, B.Sc. Teaching and Research assistant, The Faculty and Transport and Traffic Engineering, Belgrade University, milosmarina993@gmail.com

None of these Regulations I of the law covers the intersection of helicopter air traffic and road traffic, be it road roads for road vehicles and pedestrian paths intended only for pedestrian traffic.

The basic elements of a civilian helicopter (performed in accordance with ICAO AN 14 Vol II) are:

- hovering surfaces, approach and landing areas and take-off and initial climbing (TLOF, FATO),). TLOF (Touch-down and Lift-Off Area) is the ground (touch) and separation surface when a helicopter takes off from the surface; FATO (Final Approach and Take-Off Area) is the surface of the final approach and take off from the heliport;
- FATO (Safety Area-SA) is a defined surface on a helipad that surrounds FATO without obstacles (not applicable to navigation aids) intended to reduce the risk of damage to a helicopter accidentally diverted from the FATO surface;
- a road service that serves heliport landing and take-off areas and connects the heliport with the traffic system of the region and
- Takeoff landing plane or planes extending from the SA end to 152 m in height from the TLOF surface, which allow helicopters to fly during pre-landing approach landings and initial post-hover climbing.

During the initial climb and approach flight operations, the helicopter is very close to the ground.

The basic problem arises when road users, drivers and pedestrians, may be surprised by a helicopter flying in low flight above them in approaching a landing hover or after hovering in takeoff when the helicopter begins initial climb. As a result of this, motorists are left unsurprised by the unintended management of a motor vehicle in road traffic, which may endanger them and the vehicle and other road users and create the conditions for an accident. Another reason is the existence of a forced helicopter landing on the roads, after engine failure after take-off and initial climb or during landing approaches, and when there are intersections of helicopter flight paths and road / pedestrian paths.

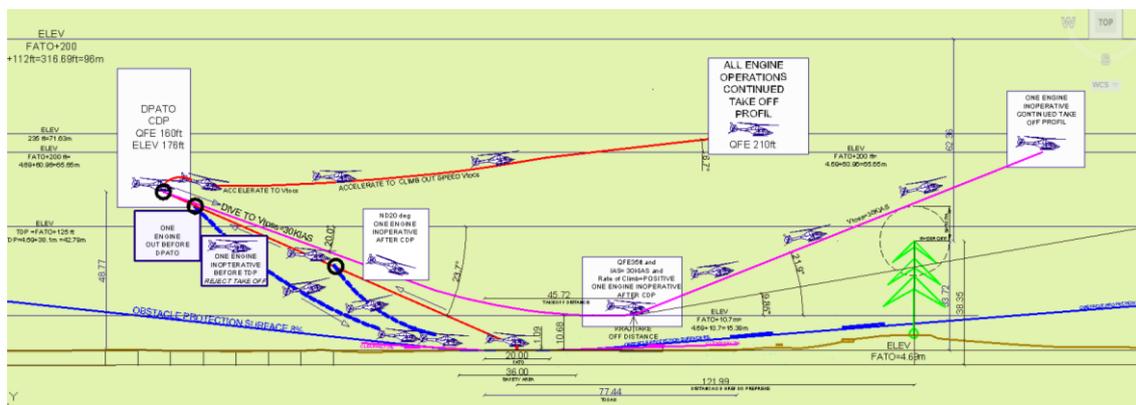


Figure 1. Analysis of forced landing of Bell212 helicopters after engine failure in initial climb

2. EXAMPLES OF CROSSING HELICOPTER APPROACH AND FLYING WITH SOCIAL TRAFFIC

The first case of intersection of helicopter and road air traffic is a heliport in a tourist complex. There was a problem of control and regulation during the helicopter fly over the internal roads of the tourist complex. In all cases of take-off and landing, one part of the operations at the heliport is carried out above the internal roads of the tourist complex. In the parts of the beginning of the cross-section of the landing planes on both sides and of the roads, traffic signs are placed which clearly indicate helicopter traffic in that part of the road.

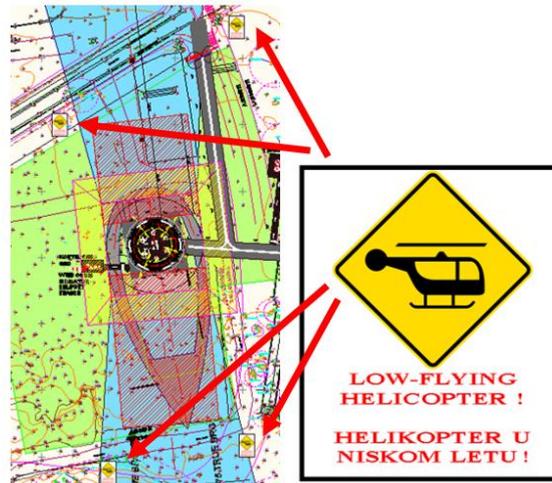


Figure 2. Location of traffic signs indicating the presence of low-flying helicopters. Marking of road roads in the tourist complex and footpaths in the City Park, traffic sign on the presence of low-flying helicopters

Another interesting case is the heliport in Gornji Milanovac. A significant feature of the area around the heliport is the hilly area with the Despotovica River bed and the State Route I B of line 22. State road B of line 22, commonly called the Ibar Highway, is the state road of the first B line in Šumadija and western Serbia.

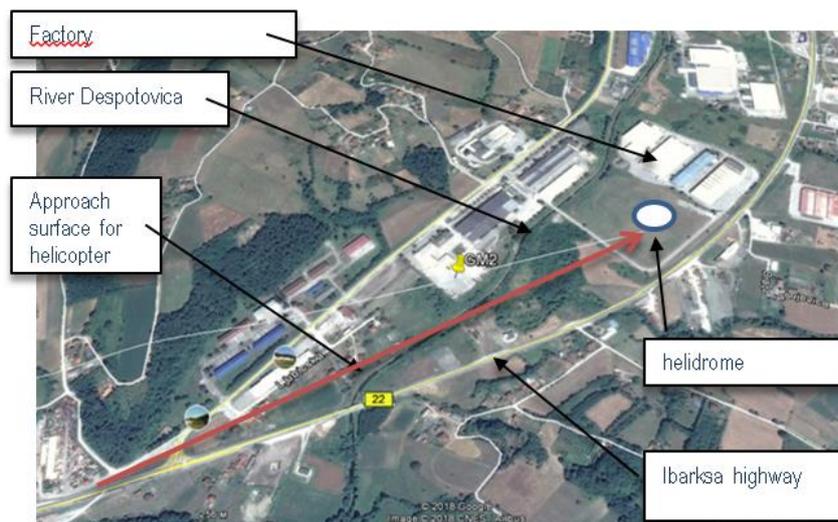


Figure 3. Location of the basin through which the river flows and extends the Ibar Highway and the access road with a description of the surrounding structures

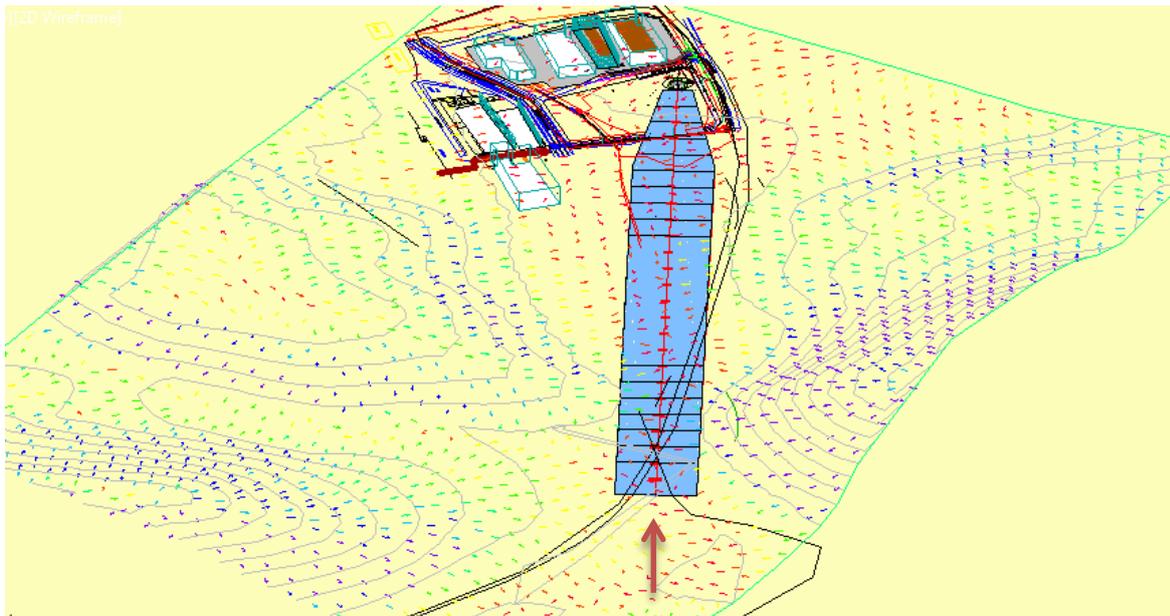


Figure 4. Location of the basin that crosses the river and extends the Ibar Highway and the ravine, details of the depiction of the terrain falling around the basin

The direction of take-off of the priority plane of the helicopter is oriented south-west between and above the industrial structure surrounding the helicopter. The direction of departure of the priority plane is over between the river bed and the Ibar Highway in the first 305m (parallel to the water distribution network at a distance of 127m from the axis of the plane), determining the approach route 62.40850 GEO BRG and departure in the direction 242.40850 GEO BRG. After the first 305m it continues in a more straight line. After the route, it continues straight in the flight course 242,40850 GEO BRG. The final part of the flight is performed over the Ibar Highway.

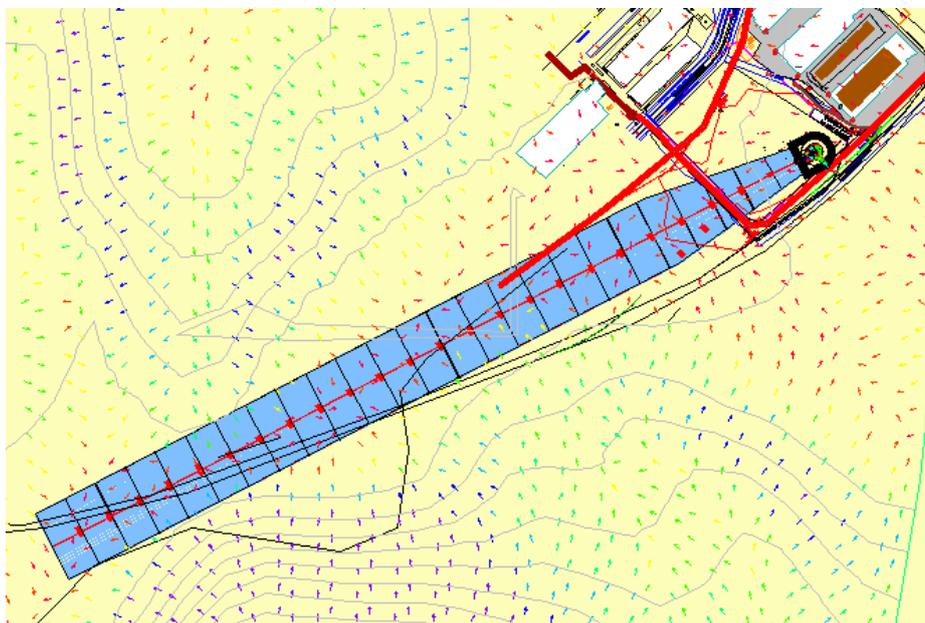


Figure 5. Horizontal projection of summer landing level 62,4085 GEOBGR -242,4085,08GEOBGR

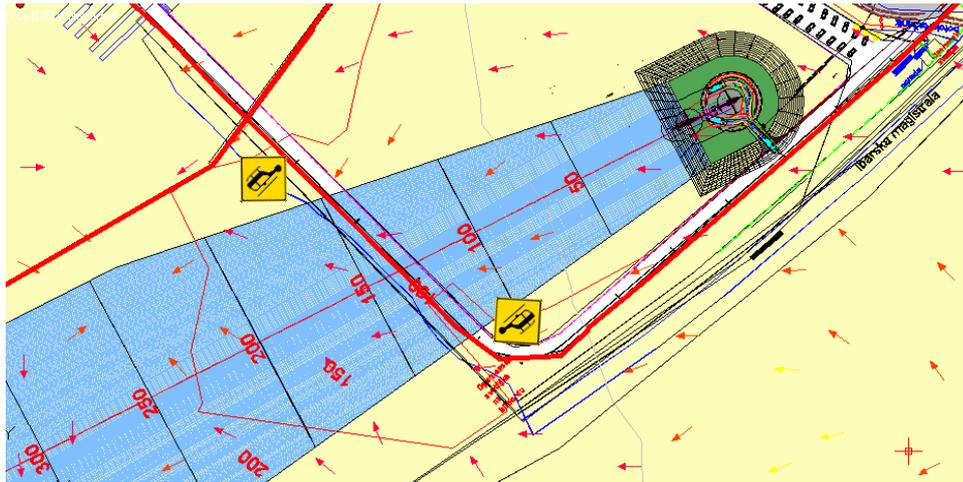


Figure 6. Putting traffic signs on the road above which helicopters fly

3. WORLD EXPERIENCES OF REGULATING CROSS-BORDER TRAFFIC AND OTHER TRAFFIC

In the world of literature and regulation, very few elements have been found to ensure the intersection of helicopter air traffic and road traffic. The following figure shows the traffic signs used in Denmark and the USA. In addition to these systemic solutions, ad hoc solutions are the most commonly used palliative solutions.



Figure 7. Warning road sign used in Denmark - Low-flying helicopters (https://www.123rf.com/photo_62979710_warning-road-sign-used-in-denmark-low-flying-helicopters-.html)
Low Flying Helicopters Or Sudden Helicopter Noise Likely Ahead Road Sign (<https://www.hirstsigns.co.uk/low-flying-helicopters-or-sudden-helicopter-noise-likely-ahead-road-sign>)

4. RESULTS OF ANALYSIS OF THE AIRCRAFT TRAFFIC ISSUES OF HELICOPTER AND ROAD TRAFFIC

During the multi-year study of this problem, the following effects of helicopters on other road and pedestrian traffic students were observed.

A low-flying helicopter generates a vortex below its surface of motion that can create rotational motion and affect the trajectory of pedestrians and vehicles below the helicopter approach and flight.

The effect of a sudden noise and movement of a large object in the air just above the vehicle and / or pedestrian may create a surprise and cause fear in road users, which can result in uncontrolled changes in the vehicle's trajectory, which can result in a traffic accident.

In the event of a sudden failure of the helicopter propulsion group in the approach and initial climb, the helicopter performs a forced landing. If the approach or departure trajectory is above the road, the helicopter forcibly lands on vehicles and pedestrians, thus directly causing a traffic accident.

For helicopters, there is a main rotor and a tail rotor. In the event of failure of the helicopter tail impeller drive, it is impossible to maintain proper flight and the downward spiral helicopter falls on the roads and road users. Today there are cases of such forced spiral landings of helicopters with fatalities of road users who were below the point of contact between the helicopter and the road.

The case of low visibility conditions and cases of storm or severe weather and stormy wind conditions cannot be taken into consideration, as helicopter traffic occurs in almost 95% of cases in visual flying conditions (VMC -Visual Meteorological Conditions). VMC conditions exclude helicopter flying in low visibility conditions and in complex weather conditions. The remaining 5% takes place in IMC conditions and involves landing at aerodromes equipped for instrument landing. These cases again exclude the crossing of road and air by helicopters.



Figure 8. Consequences of Forced Helicopter Landing in Florida helicopter crash land on a busy Tampa road, man dies on ground (<http://webtopnews.com/florida-helicopter-crash-land-on-a-busy-tampa-road-man-dies-on-ground-13663-2019/>)

5. DISCUSSION OF THE PROPOSED CROSSING CONTROL SOLUTION

From all of the above, an initial solution to the problem of the intersection of air traffic and road traffic may be sought. It is proposed to apply an analogy with the intersection of rail and road traffic. For decades, the problem of the intersection of rail and road traffic has been successfully solved and implemented in practice and regulation (Obradović et al.2019). By studying rail and road technology, the following analogies can be clearly identified with the intersection of helicopter and road air traffic:

- Cross-border vehicles are moving at different speeds, and the technology of rolling stock movement is completely different from that of road vehicles
- The masses and forces of the rolling stock of the vehicles subject to the crossing are of drastically different masses and forces
- The basis on which the movement of assets that are involved in the crossing is performed is completely different. For rail transport, these are the rails for road traffic, an asphalt pavement is used.

6. CONCLUSION

It can be concluded that there is an analogy between the intersection of helicopter and road traffic and the intersection of rail and road traffic.

Recommendations for improving air and road safety could be summarized as follows. Urgent changes to the aviation and road traffic regulations are needed, in order to introduce a system of control and regulation of the crossing of two types of traffic. In addition to the solutions so far, which included only the placement of traffic signs, it is necessary to include light and audible warning signals, which affect the field of vision of drivers and pedestrians to complete information on the helicopter's arrival. In addition, below the landing plane intersecting the road, it is necessary to completely suspend traffic until the helicopter completes the approach or initial climb operation. In addition to amending the aviation regulations, it is necessary to amend the Road Safety Act with a particular emphasis on

- Priority of crossing of the crossing point, with priority given to helicopter I
- The behavior of the driver when he arrives at the marked intersection of helicopter air traffic and road in case d at the intersection there is no audible warning and no warning and no closure of the road by ramps.

Demanding urgent and proactive action is necessary because in the very near future mass traffic is announced for drones for the transportation of passengers in the densely populated city center. The illustration of this problem can already be summed up by the use of drones to deliver parcels to a courier service in a densely populated city center. The chaotic situation that now prevails in addressing the problems of helicopters and road traffic can easily turn into a catastrophic state when massive drones for the transport of passengers are introduced into the public urban traffic of cities. In this case, these are drones of high mass and high speed of movement, and it must be known that the drones have almost eliminated all flight restrictions of helicopters. Technical solutions for flying drones are more advanced than helicopters, which will allow their rapid propulsion in urban passenger transport applications.

7. BIBLIOGRAPHY

- Directorate for Civil Aviation of Bosnia and Herzegovina (BHDCA), Rulebook on Airfields ("BiH Official Gazette", No: 85/13) (at: http://www.bhdca.gov.ba/website/dokumenti/Aerodromi/4_srb.pdf)
- Civil Aviation Agency of Montenegro, Rulebook on Criteria and Standards for the Smooth Use of Operational Surfaces, Facilities, Devices and Equipment at Helicopters (Official Gazette of Montenegro 9/2015) (on the Internet address: http://www.caa.me/cms/site_data/propisi/aerodromi/Pravilnik%20o%20izmjeni%20pravilnika%20o%20kriterijumima%20i%20standardima%20za%20nesmetanu%20upotrebu%20helidroma.pdf)
- Civil Aviation Directorate of the Republic of Serbia, Rulebook on Conditions and Procedure for Issuing a Permit for the Use of a Helicopter ("RS Official Gazette", No. 103/18) (at: <http://cad.gov.rs/upload/regulativa/2018/1.%20Pravilnik%20o%20uslovima%20i%20postupku%20za%20izdavanje%20dozvole%20za%20koriscenje%20helidroma.pdf>)
- Обрадовић Д., Великић С., Адамовић В. (2019), POSSIBILITIES FOR IMPROVEMENT OF THE PUBLIC TRAFFIC SAFETY AT THE CROSSING OF THE ROAD AND RAILROAD LEVEL OF THE VALJEVO, 14th International Conference "Road Safety in Local Community" Serbia, Kopaonik, Hotel Kraljevi Čardaci, April 10 – 13, 2019.