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Proceedings of the 11th Annual International Conference on
Civil Engineering and Infrastructure

Edited by
Edmond Hajrizi



Leadership and Innovation

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A large graphic on the left side of the cover consists of several concentric, semi-circular arcs. The top four arcs are a medium blue color, and the bottom three arcs are a light blue or white color. The arcs are arranged in a way that they appear to be part of a larger, incomplete circle.

PROCEEDINGS

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CONFERENCE

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29-30
OCTOBER

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Editor Speech of IC - BTI

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Congratulation!

Edmond

Hajrizi, Rector of UBT and Chair of IC - BTI 2023

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School Building under Fire Risk Assessment

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Abstract. In this paper, a qualitative and quantitative fire risk assessment of school building in Kumanovo, North Macedonia, was conducted. The elementary approach of Five Steps and the 5x5 Matrix Method for fire risk analysis were used to define the fire risk. As quantitative method, Euro-alarm Method was used to define all parameters that influence the fire risk. Based on the results of the performed analysis, it was found that the school does not meet the fire safety measures and this is due to the following factors: lack of appropriate fire protection measures, lack of fire detector and lack of fire department.

Keywords: Matrix Method, Euro-alarm Method, fire, fire assessment

1 Introduction

Fire as uncontrolled combustion, either of a part of a structure or of a flammable material in its vicinity, can cause injury to people and material damage. To prevent the occurrence of fire and if it happens to guarantee the safety of people as well as the building itself and the material goods in it, appropriate measures should be taken.

Based on it, a qualitative and quantitative fire risk assessment was conducted for Secondary School in Kumanovo, North Macedonia. Measures for protection against fire have been the subject of research, namely, whether they exist and, if they exist, whether they are appropriate and sufficient for the management of hazards causing fires, or whether they should be improved.

Assessment of the risk pertaining to a fire outbreak in the structure has been made by means of a prepared and realized poll based on the Elementary Method for assessment of the risk pertaining to a fire outbreak. In combination with the Matrix Method the fire risk was defined.

For quantitative fire risk assessment, “Euro-alarm” Method, which is the basis for making decision about installation of an automatic stationary system for fire extinguishing as well as taking of additional measures for protection against fire, was applied. Based on the results obtained from the both analysis, additional fire protection measures are recommended.

2 Qualitative Fire Risk Assessment

From the poll conducted at Secondary School in city Kumanovo, North Macedonia, it has been concluded that the structure is in medium conditions from the aspect of conditions related to protection against fire.

The probability for fire outbreak in this building is **Possible (3)**, [6]. The poor condition of the building ensures rapid spread of the fire, due to the presence of flammable materials inside the building, lack of fire department, fire doors and stairs. This means that the fire will be followed by enormous consequences, especially from the aspect of losing human's lives. The fire risk is **High (4)**, [6].

According to Matrix Method, the risk value is obtained as product between the probability and the impact:

Value of the fire risk = fire hazard (probability) x fire risk (impact).

The numerical value of the fire risk is defined according to Table 1, while the Matrix method is presented in Figure 1. Based on the obtained results, **the value of the risk is 12** and **the fire risk belongs to category Medium**.

Table 1. Relationship between fire hazard and fire risk

Fire Risk Description	Value	Fire Hazard Description
Very Low	1	Rare
Low	2	Unlikely
Medium	3	Possible
High	4	Probable
Very High	6	Highly Probable

Fig. 1. 5x5 Matrix method for defining the numerical value of the fire risk

3 Quantitative Fire Risk Assessment

The quantitative „Euro-alarm“ method is based on the fire risk of the building (Eq. 1) and the fire risk of the building content (people, furniture, etc.) (Eq. 2), as two highly related components [4]. The risk related to fire outbreak for the structure depends on the possible intensity and duration of fire due to structural characteristics, i.e., bearing elements of the structure (resistance of the structure to high temperatures) and is computed

(1)

where:

R_o – fire risk of the building;

P_o – coefficient of fire load of the building content;

C – coefficient of combustibility of the contents in the building;

P_k – coefficient of fire load of materials installed in the construction of the building;

B – coefficient of size and position of the fire sector;

L – coefficient of delay in the start of extinguishing;

S – coefficient of a width of the fire sector;

W – coefficient of fire resistance of the load-bearing structure of the building;

Ri – fire risk reduction coefficient.

The fire load has been adopted in accordance with the standard MKS. U.J.1.030 [3] and for classrooms it's value is $q=251$ (MJ/m²). The coefficient of fire load of the building content (P_0) is determined according to Table 2.

The coefficient of combustion of the contents in the building (C) depends on the class of fire danger. According to MKS U.J.1.030 standard [3] school building belongs to the 4th hazard category. Based on it, the value of the combustibility coefficient is $C = 1$. The coefficient of fire load of materials built in the structure of the building (P_k) is obtained based on the calorific value of all combustible materials in the building. For RC structure has no caloric value, and $P_k=0$. The coefficient of size and position of the fire compartment (B) depends on the size of the fire compartment's floor area, the height of the premises and the number of floors. For three storey building with fire sector up to 1500 m², height of premises up to 10 m, the value is $B=1$. The coefficient of delay in the start of the intervention (L) depends on the type and equipment of the fire brigade, its distance from the building and the condition of the roads. For territorial fire fighting unit where the distance between the fire station and secondary school is 2.3 km, the value for delay coefficient of the extinguishing start is $L=1.1$. The fire compartment width coefficient (S) is determined based on the fire compartment width. In case when the least width of the fire compartment is from 20 m to 40 m the value is $S = 1.1$. The coefficient of fire resistance of the load-bearing structure of the building (W) is determined depending on the elements from which the building is constructed. In this case the RC structure has fire resistance that is usually higher than 90 minutes (Table 3).

Fire risk can be reduced by using the fire risk reduction coefficient (Ri), in regard to the type of combustible materials, combustion rate, storage method and other factors. In this case the flammability is not particularly high, normal speed of fire spreading is expected and in the process of functioning, there are normal sources of ignition. The value is $Ri=1.3$.

Table 2. Coefficient of fire load of the building content (P_0)

Heat power - P_0 (MJ/m ²)	P_0
0÷251	1
252÷502	1.2
503÷1004	1.4
1005÷2009	1.6
2010÷4019	2
4020÷8038	2.4
8039÷16077	2.8
16078÷32154	3.4
32155÷64309	3.9
64310 -	4

Table 3. Coefficient of fire resistance of bearing structure (W)

Resistance to fire in (min)	W
At least up to 30	1
30	1.3
60	1.5
90	1.6
120	1,8
180	1.9
240	2

By incorporating the defined parameters into Eq. 1, the value of fire risk becomes: $R_o=0.58$. In case $R_o < 1$, the structure should be manual extinguishers as are portable and vehicle mounted extinguishers. This criterion is satisfied.

The risk related to fire outbreak to which the contents of the structure (danger for the people, the equipment and alike) are exposed is indicated by R_s and is defined by Eq.2.

(2)

where:

H is coefficient of danger to humans;

D is asset risk ratio;

F is coefficient of smoke action.

The risk factor for people (H) depends on the possibility of timely evacuation of people from the facility and is given in Table 4. The asset risk ratio (D) depends on whether the destroyed property can be recovered and the extent of material losses. In case when the contents of the structure are not of high value and have a low tendency to destruction the value is $D=1$. The appearance of a larger amount of smoke increases the threat to people and property, which is taken into account through the coefficient of action of smoke (F). In case when more than 20% of the total weight of all flammable materials cause smokiness, or release poisonous products from combustion the value is $F=1.5$ [4]. For the analysed building, the final value of R_s is: $R_s=3$

Table 4. Danger to which people are exposed H

Level of endangerment	Coefficient H
There is no danger for the people in the structure	1
There is danger for the people in the structure, but they can save themselves	2
There is danger for the people and evacuation is aggravated (high smokiness, large number of present persons, fast spreading of fire, multi-storey structure, presence of disabled persons – sick persons, old people, children)	3

The obtained values for these two components are plotted on the ordinate and abscissa of the Fire risk decision diagram (Figure 2). Each combination of building fire risk and fire risk of the contents of the building corresponds to a particular point on the diagram. The position of the point can be used to decide whether it is justified to take additional fire protection measures. **In this case zone 1 means that the risk is very low, so preventive measures are sufficient.**

Fig. 2. Fire risk decision diagram

4 Conclusion

In accordance with the conducted research, it can be concluded that the Faculty of Business Administration is in medium condition and does not fulfill all the necessary measures for protection against fire.

The analysis has shown that, for fast and initial, but still sufficiently accurate assessment of the risk pertaining to fire outbreak, one can use quality methods as are the Matrix Method and the Elementary Five-Step Method.

Based on the obtained results it can be concluded that the application of quantitative methods, as the “Euro-alarm” Method, is more effective and these methods are used for more detailed analyses in assessing the risk related to fire outbreak in a specific structure.

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A simulation analysis model that impacts the vehicle end pedestrian (V=50 km/h)

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Abstract: The paper deals with traffic accidents of the “Pedestrian Hit by a Vehicle” type, creating the model through experimental tests, time and space kinetic analysis, as well as the reconstruction of accidents through the Software PC-Crash version 8.1 program. Through experimental tests, the elements of the road and vehicle factors were taken: road elements (roughness of the old and new road surface), vehicle elements (braking system equipped with and without ABS - anti-lock system), while driving the vehicle at 50 km/h during the test, sudden braking was applied, where the criterion for avoiding contact with pedestrians from the vehicle was the shortest braking trace left by the vehicle after the end of the braking process, i.e. stopping the vehicle. At the end, the real causes of road and vehicle elements in the accident are given, as well as the percentage of influence of road and vehicle factors in proportion to the human factor in accidents of the “Pedestrian Hit by a Vehicle” type.

Key-words: Model for identifying the causes of accidents.

1. INTRODUCTION

Today, even in the developed countries around the world, the traffic problem is not entirely solved. Despite the scale of investment opportunities, especially post-1960, developed countries are attempting to mitigate this problem through business and management measures. The institutions responsible for addressing traffic issues have made urban traffic problems unbearable, most accompanied by an understanding of the need for high-cost investments (Kizolli, 2017).

The development of highways, which indicates the level of development of countries, has also caused some problems. Increasing the number of vehicles and drivers is one of the sole causes of these issues (BAK , et al., 2019).

Approximately 1.3 million people die each year as a result of road traffic crashes (World Health Organisation, 2022)., and the factors that cause these fatal accidents can be categorized in: human factor 85 %; road factor 8-10 %; vehicle factor 3-5 % (Dedaj , 2016), while 40% or 480,000 of the victims in road traffic are pedestrians (Gopalakrishnan, 2012).

The death risk for pedestrians hit by car fronts rises rapidly (4.5 times from 50 km/h to 65 km/h). (World Health Organisation, 2022).

2. MATERIALS AND METHOD

By the fact that an accident could causes one or more factors or elements thereof, then we tried to make research the cause of the accident elements, the factor vehicle and the factor road, where is a suspicion that the percentage that causes the human factor of 85% is huge.

The results are obtained during tests experimental with vehicles equipped with ABS and without ABS, with new pneumatic and the oldest, who moves on new roads and old at a speed of 50 km/h.

The ABS braking system is a system designed to improve driving safety while braking. A locked wheel will not withstand lateral force. The locking wheels also make the vehicle slide straight ahead. If that vehicle enters the curve, the steering control disappears and it slides of the curve. In other words, while locked rear wheels destabilize the vehicle, locked front wheels eliminates steering control (ŞAY , 2007).

Developed and patented for the first time in Germany in 1936, ABS is abbreviated from the German term "antiblockiersystem" and its English is "Anti-lock Brake System" with a similar meaning (Gazi Üniversitesi Teknik Eğitim Fakültesi, 2005).

Table 1. Presentation of results obtained in tests under specified experimental conditions (Easy Street Draw)

Nr.	V	F	b	S ₄	pa	me	p.v.	p.r.	rr.r.	rr.v.	S _{4pg}
Ren.	Km/h	kN	m/s ²	m	ABS	ABS					m
1	50	196	9.24	10.30		x	x		X		0.00
2	50	324	7.80	10.70		x		x	X		0.40
3	50	330	8.28	10.75	x			x		X	0.45
4	50	290	8.24	12.01	x			x	X		1.80
5	50	202	7.90	12.20	x		x		X		1.90
6	50	322	7.70	14.10		x		x		X	3.80
7	50	298	8.30	14.10		x	x			X	3.80

Anti-lock braking systems (ABS) have been installed on all passenger cars in recent years. This electronic control system prevents the wheels from locking-up and thus improves braking performance while assuring the handling of the car. Modeling the ABS is essential in order to simulate the vehicle behavior during braking and to achieve a good agreement between the vehicle model and the experimental data (Cheli, Concas, Giangiulio, & Sabbioni, 2007).

3. RESULTS

Based on the results obtained during the tests in the specified experimental conditions and the use of the "Easy Street Draw" program, in the following we have provided some results that allow us to draw some conclusions.

Figure 1. Are presented braking traces and the final position of the vehicle

Figure 3. The length of the trace represents the braking left by the vehicles during the test

Figure 4. Shows the vehicle's brake traces on the pedestrian lines and movements to stop the vehicle

Table 2. The results obtained after analyzing the cases of kinetic vehicle – pedestrian accidents

Nr.	ren.	1	2	3	4	5	6	7
V	km/h	50	50	50	50	50	50	50
F	kN	196	324	330	290	202	322	298
b	m/s²	9.24	7.80	8.28	8.24	7.90	7.70	8.30
S_a	m	10.30	10.70	10.75	12.01	10.20	14.10	14.10

pa	ABS			x	x	x		
me	ABS	x	x				x	x
p.v.		x				x		x
p.r.			x	x	x		x	
rr.r.		x	x		x	x		
rr.v.				x			x	x
S_{4pg}	m	0.00	0.40	0.45	1.80	1.90	3.80	3.80

Table 3. The elements that show at the time of the accident

1	ren.	1	2	3	4	5	6	7
V	km/h	50	50	50	50	50	50	50
F	kN	196	324	330	290	202	322	298
b	m/s²	9.24	7.80	8.28	8.24	7.90	7.70	8.30
S₄	m	10.30	10.70	10.75	12.01	10.20	14.10	14.10
pa	ABS			x	x	x		
me	ABS	x	x				x	x
p.v.		x				x		x
p.r.			x	x	x		x	
rr.r.		x	x		x	x		
rr.v.				x			x	x
S_{4dg}	m	10.30	10.30	10.30	10.30	10.30	10.30	10.30
S_{4pg}	m	0.00	0.40	0.45	1.80	1.90	3.80	3.80
S_n	m	24.28	26.20	25.49	25.54	26.05	26.36	25.46
V₁	km/h	47.51	47.90	47.77	47.78	48.87	47.93	47.76
V_g	km/h	0.00	9.00	9.84	19.63	19.75	27.58	28.63
V_{ik}	km/h	49.93	49.92	49.94	49.93	49.93	49.92	49.93
t_n	s	2.50	2.78	2.67	2.68	2.75	2.80	2.67
t_r	s	1.66	1.94	1.84	1.84	1.92	1.96	1.83
t₄	s	1.42	1.70	1.60	1.61	1.68	1.72	1.60
t_{fdg}	s	1.42	1.62	1.50	1.18	1.22	0.96	0.87
t_{gg}	s	0.00	0.08	0.10	0.43	0.46	0.76	0.73

Simulation of accidents where the potential for an accident was avoided and the second case could not be avoided. (PC-Crash 8.1.)

Table 4. Under the ordinal number 1 and 7, are shown avoiding the possibility of contact-infantry vehicle, i.e., contact between the vehicle and the pedestrian

Table 51	ren.	1	7
V	km/h	50	50
F	kN	196	298
b	m/s²	9.24	8.30
S₄	m	10.30	14.10
pa	ABS		
me	ABS	x	x
p.v.		x	x
p.r.			
rr.r.		x	
rr.v.			x
S_{4dg}	m	10.30	10.30
S_{4pg}	m	0.00	3.80
S_n	m	24.28	25.46
V₁	km/h	47.51	47.76
V_g	km/h	0.00	28.63
V_{ik}	km/h	49.93	49.93
tn	s	2.50	2.67
tr	s	1.66	1.83
t₄	s	1.42	1.60
ufdg	s	1.42	0.87
tgg	s	0.00	0.73

Figure 5. Presents 2D and 3D test nb.1, where the vehicle has a speed of 50 km/h, and there is no contact between the vehicle and the pedestrian.

Figure 6 Presents 2 and 3D test nb.1, where the vehicle has a speed of 50 km/h, and it has come into contact with the middle of the vehicle and pedestrian

Analysis of real Vehicle-pedestrian accident and the slowdown of vehicle coefficient "b" during the process of braking the vehicle:

Table 6. Elements of the vehicles which have caused the accident by the road-vehicle-pedestrian factor

order number	speed (km/h)	The causes of the accident	Factors causing accidents
1.	50	with ABS, old pneumatic and new road	/
2.	50	with ABS, new tires and new road, (pneumatic properties)	Vehicle
3.	50	without ABS, new pneumatic and old road	Road
4.	50	without ABS, new pneumatic and old road	Vehicle
5.	50	without ABS, old pneumatics, and the new road	Vehicle
6.	50	with ABS, new pneumatics, and the old road	Road
7.	50	with ABS, old pneumatics, and the old road	Vehicle and Road

Table 7. Presents the slowdown coefficient during braking of vehicle during the tests.

Nr		1	2	3	4	5	6	7
V	km/h	50	50	50	50	50	50	50
b	m/s ²	9.24	7.8	8.28	8.24	7.9	7.7	8.3
pa	ABS			x	x	x		
me	ABS	x	x				x	x
p.vj.		x				x		x
p.ri.			x	x	x		x	
rr.re		x	x		x	x		
rr.vj.				x			x	x

4. CONCLUSION

Kinetic analysis of the entire testing process where vehicles have moved rapidly from 50 km/h, with the conditions laid

down in advance and come to the conclusion that elements of accidents with road-vehicle factors are the cause of vehicle-pedestrian in this percentage: 60% the factor vehicle while 40% the factor road, where it follows that:

1. The human factor is the cause of accidents with < 85%.
2. The vehicle factor is the cause of accidents with > 5 %.
3. The road factor is the cause of accidents with > 10 %.

During kinetic analysis of vehicle-pedestrian accident the experts could use Table 5 where are described the slowdown as coefficient and come to the much more real conclusion on the elements of the factors that have caused the accident.

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Carpool as a solution contemporary for the improvement of the transportation: The example of "Adem Jashari" Barracks

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Abstract: In post-war Kosovo, developments, and extensions in the capitals, and especially in the capital, have brought with them a series of complicated problems. Despite the infrastructural investments in this period, the dynamic life of the market development and the consolidation of the institutions has reflected in a dynamic life, carrying in itself many demands. One of the most vital requirements remains transportation, which affects individual budget, safety, convenience and time wastage. However, all these changes have not met the conditions for a proper urban transport and it has not affected the reduction of the use of private vehicles. In this regard, the improvement of urban transport conditions remains a priority, but also the expansion of alternatives aiming the reduction of the use of personal vehicles and enabling orientation to alternatives in order to contribute to improving the level of traffic service and preventing environmental pollution. Based on trends in developed countries, where transport demand management strategies remain their preference. In this paper, we are defined in the strategy of travel, being limited to its contribution within the institution such as the Barracks "Adem Jashari" in Pristina, with the aim of presenting as a strategy for other institutions or enterprises in the country.

Keywords: Adem Jashari Barracks, Prishtina, Transportation Demand Management, Travel

1. INTRODUCTION

Road traffic in the city of Pristina is a complex issue because of the long boring and stressful queues occurring in everyday life caused by the great demand for travel over the years. High number of pedestrians and the large flow of vehicles threatens the urban transportation safety due

to the usage of the same road strip. Taking into account the poor state of urban transportation in the Municipality of Pristina, citizens have been pushed to use private vehicles as means of transportation, since the urban transportation does not offer quality services and has lost its credibility among them. As a result, in our case study, the determination to carry out transportation with private vehicles has influenced the high flow of vehicles, which creates loads in the parking lots of Barracks.

The research on the abovementioned issue has started by researching the literature of this field and by means of the survey of the members of the KSF, leading to some conclusions deriving from the obtained results. The results of the survey have shown that a large number of respondents have admitted that the carpooling strategy would be one of the possible travel solutions, as it would affect the reduction of vehicles in the parking lots inside the Barracks and the reduction of vehicles in traffic. It would also have a positive impact on the social and economic life of the members as they would have greater opportunities to socialize with each other but would also save economically by sharing the costs of travel and vehicle maintenance.

2. MATERIALS AND METHOD

The working literature on this topic is divided into three different points, such as: Plans and Projects related to urban transportation in the Municipality of Pristina, Scientific Papers and Notes of University Lectures. The condition and analysis of the transport of members in the "Adem Jashari" barracks has been addressed starting from the condition of the infrastructure inside the barracks, indicating the condition of the roads, horizontal and vertical signaling, the condition and number of parking lots and whether these parameters meet the requirements for all vehicles, as well as the number of members and employees serving in the "Adem Jashari" barracks and their financial situation and social life (education, employment and recreational activities) inside the barracks.

Infrastructure – the condition of the roads inside the "Adem Jashari" barracks is at a satisfactory level, since the standardization starts from the conceptual plan, until the completion of a road, by accurately calculating all the necessary infrastructure inside the barracks (Technical Report, 2013). Within the premises of the "Adem Jashari" barracks there are 3 (three) official parking lots and 1 (one) alternative parking lot. Parking lot no. 1 is located at the entrance gate no. 1 and has the capacity up to 100 vehicles, whereas the parking lot no. 2 is located at entrance gate no. 2 and has the capacity up to 170 vehicles. The alternative parking lot has the capacity up to 60 vehicles and is used only when parking lots no. 1 and 2, and the parking lot at the Ministry of Defense are full, or in cases of various ceremonies in the barracks.

In the "Adem Jashari" barracks there is a considerable number of members and employees who cannot be mentioned with an exact number due to military confidentiality, however with the authorization of General Staff of the Security Force of Kosovo the approximate number is around 800 members and employees, and some of them we can assume that they travel with private vehicles (Assembly of the Republic of Kosovo, 2018).

The financial situation of the members of the Kosovo Security Force depends on the position and rank in which they serve (Assembly of the Republic of Kosovo, 2018).

Taking into account the financial situation of the members and the load that is being created on the roads in the direction of the barracks, the Kosovo Security Force has drawn up the policies of providing organized transportation for the members of the KSF who travel from different cities to support the members of the KSF financially and at the same time to contribute to the unloading of the roads from the vehicles of the KSF members, and also with the aim to provide a significant contribution through this practice as a large part of its members have the opportunity to use the transportation organized by KSF (Ministry of Defense, 2019).

However, for members who do not have the opportunity to use organized transportation as they live in places close to the barracks, they can use other travel alternatives such as public transportation, taxis or even share private vehicles with colleagues or friends working also in other institutions of the Republic of Kosovo (Assembly of the Republic of Kosovo, 2018).

Social life - Based on the collegial and social closeness among the members of the KSF, there is a space of free collegial and social communication between Soldiers, Non-Commissioned Officers and Officers, where from this free communication the family situation of the members and their needs for advanced and specialized trainings are understood.

The social closeness between the members is strengthened even more during the 1-hour break time, which is spend for food and some drinks at the buffet located inside the "Adem Jashari" Barracks, also including sports and artistic activities organized for Independence Day on 17th of February, and various other annual manifestations such as the Epic of the KLA and the Day of Strength on 27th of November which is an open day for the presentation of KSF equipment to the citizens, as well as various sports tournaments among KSF members that are organized in honor of the November holidays, etc. (Assembly of the Republic of Kosovo, 2018).

Organized transportation – While mentioning the financial situation and the communication between KSF members, organized transportation and carpooling are some of the possible solutions for supporting KSF members both financially and socially by giving them more space for communication among themselves. Although the transportation is organized by the KSF (table. 1), it is still not sufficient to cover the needs of transportation of all members and employees working in the KSF since besides 800 members and employees the organized transportation is also being used by employees of private company contractors of KSF working in kitchen and cleaning departments, which causes an increase up to 900 employees and higher demand for parking lots.

Table 1. Organized transportation by KSF vehicles

Amount	1	5	6	6	17
Type	2	Van 8+1	Minibus 20	Bus	TOTAL
Personnel	3	45	117	268	430
Annual KM	4	173,304	152,424	181,134	506,862
Fuel	5	17,330.40	15,242.4	18,113.4	50,686.20
Tires	6	1,400.00	2,520	9,600	13,520.00
Insurance	7	1,650.00	4,020	5,802	11,472.00
Maintenance	8	5,760.00	9,000	12,300.	27,060.00
Amortization	9	5,300.00	18,000	47,400	70,700.00
Drivers	10	-	12,960	12,960	25,920.00
Total	10 = 5 to 10	31,440.4	61,742.4	106,175.4	199,358.2

As a need to provide a clearer overview of the situation, mood and connections related to the transportation of KSF employees, we conducted a survey of 10 questions, where two of them are related to demographics and eight questions related to the topic itself.

3. RESULTS

Based on the figure of 800 employees, if all the employees came with personal vehicles, then 800 parking spaces would be needed, but considering the limited parking spaces, such a thing is impossible to implement (Ministria e Mbrojtjes, 2019).

However, if 4 passengers traveled with one vehicle, then the number of vehicles needed would be somewhere around 200 vehicles, a figure that would perfectly correspond to the current parking lot capacity, but which would increase the number of vehicles in traffic compared to transport organized by KSF. (Kellogg, 2021).

Table 2. Overview of responses obtained through survey.

Sex	F/M	203	59	262
Age	18-33	120	45	165
	34-50	79	13	92
	Over 51	4	1	5
Personal income	380-500	126	45	171
	501-650	38	7	45
	651-750	19	4	23
	Over 750	20	3	23
Mode of travel	Transport organized by KSF	97	0	97
	Personal vehicles	90	25	115
	Urban transportation	32	18	50
When traveling with personal vehicle	Travels alone	90	34	124
	Travles with colleagues	113	25	138
Do you accept travel companions in your vehicle	Yes	180	50	230
	No	23	9	32
If you are carpooling do you share expenses with travel companions	Yes	20	60	80
	No	130	52	182
Being stuck in traffic while traveling affects	Late for work	134	23	157
	Physical fatigue	9	0	9
	Mental fatigue	60	36	96
Carpooling in your financial situation if you will be carpooling with colleagues	Yes	158	49	207
	No	45	10	55
How much would it affect your financial situation if you were to travel with colleagues?	Not at all	106	5	111
	Little	40	23	63
	A lot	57	31	88

The overview of the results obtained from the survey with 262 participants of different age groups are presented and divided depending on the financial income of the members and employees of the KSF in table no.2.

We have also conducted an analysis of the results obtained from the survey, which it is shown below.

Summary comment:

- 31% stated that this strategy does not affect the financial aspect.
- About 30% have declared that they are affected a little, while 39% have declared that they are affected a lot. Taking as a basis those who answered a little and a lot, the result shows that we are dealing with 69% of respondents who think that this strategy affects the financial situation (table .2.).

Table 3. Overview of responses from the survey, separated depending on the financial income

Personal Income	380-500			501-650			651-750			mbi 750		
	175			39			23			25		
Mode of travel	a	b	c	a	b	c	a	b	c	a	b	c
	57	88	30	21	0	18	11	10	2	8	17	0
When traveling with personal vehicle	a	b	c	a	b		a	b		a	b	c
	73	102		20	19		18	5		13	12	
Do you accept travel companions in your vehicle	a	b	c	a	b		a	b		a	b	
	163	12		30	9		19	4		18		
If you are carpooling do you share expenses with travel companions	a		c	a	b		a	b		a	b	
	46	129		19	20		10	13		5	20	
Being stuck in traffic while traveling affects	a	b	c	a	b	c	a	b	c	a	b	c
	117	9	49	18	0	21	8	0	15	14	0	11
Do you consider	a	b	c	a	b		a	b		a	b	

carpooling with colleagues a relief												
	151	24		27	12		18	5		11	14	
Carpooling in your financial situation if you will be carpooling with colleagues	a	b	c	a	b	c	a	b	c	a	b	c
	92	29	54	3	11	25	4	13	6	12	10	3

4. DISCUSSION AND RECOMMENDATION

In this article, we have addressed the indirect impacts of the implementation of the carpooling strategy in general. As a necessity of travel and as a result of investments in infrastructure to ensure safe and fast travel, many other areas were deprived of these investments. Therefore, the contemporary approach enables us to manage the travel requirements, always giving priority to public transport, and in this direction, they also stimulate strategies that have this character like carpooling as part of the contemporary approach to travel, as in our case study. With these strategies and quality management, the need for investments in infrastructure will decrease over time, and the saved budget can be directed to other social areas such as education, health, culture, sports, etc.

At the end of the 1960s, in the Western world, new handlings to alternative approaches began with the increase of public interest in social equality and environmental issues, while the oil crisis of 1974 and 1977 influenced the acceleration of this formation, which also applies to the time that we are living. These problems limit the resources of the richest countries and should pave the way for the reevaluation of the concept of efficiency. Both in industrialized countries and in developing countries, managers and experts are beginning to become more aware of these negative impacts of "solutions to increase infrastructure capacity without controlling demand".

Thus, methods-strategies have been developed in which they have served to question the quantity, quality and formation of transportation. (Kizolli, 2017). In this new approach called "travel demand management"-TDM (travel demand management in the United States of America or mobility management in Europe), the short and medium term is at least as important as the long term. Physical investments, as well as administrative, economic, legal and operational measures are becoming the main tools of the new planning concept. As in the title of the approach, now the planning of transport supply is as important as the management or formation of travel demand (Kizolli, 2019).

Urban transportation policies that will be created for our country must naturally have a structure that is far from the inappropriate aspects of traditional approaches and that includes the positive aspects of contemporary approaches. For this reason, the principles, concerns, problems and solutions that are ranked higher for contemporary approaches also apply to transportation policies. Measures within the concept of travel demand management, of course, provide important data for the design of transportation policies. Initially, this includes the solution of

short-term problems by TDM (travel demand management) (Elker, 2001). For all these reasons, the transportation policies that will be proposed for our country should include the goals and means of managing travel demand, but should not be limited to this. Anticipated policies must inevitably be built in the "now," but this "now" must be preserved, developed, refreshed, and interacted with by long-term planning leaders in the years to come. Within this approach, it is possible to classify the proposed short, medium and long-term policies according to their objectives.

The transport reduction policy is mainly aimed to reduce the total level of travel. In this context, the development of communication facilities creates an important alternative. However, this policy involves not only reducing the total level of travel, but also reducing demand in some corridors or critical hours and reducing the rate of vehicle travel. To implement these policies, it is necessary to prepare projects, design measures and implement them with determination. A classification of short and medium-term policies and related measures is presented in the following table based on the above-mentioned logical sequence (Elker, 2001).

The large number of vehicles on the road does not contribute to traffic safety, but instead it increases the possibility of accidents, and they also create a traffic load that increases fuel costs, negatively affects time and causes physical and mental fatigue and work delays (Table.2.).

Although moving with a private vehicle offers us the greatest luxury for performing services such as commuting to work and for other private needs, but as highlighted above, it has its negative sides since it increases the number of vehicles in traffic and the number of requests for parking, but nevertheless it does not mean that the private vehicle is the only choice that meets our requirements and needs, as there are other options that may not respond to the same luxury, and it positively affects the reduction of vehicles and traffic safety. As another possibility which can be a very good choice and which can save time, money and fuel is the possibility of traveling together with colleagues or even with other people who share the same road, this as a strategy of the contemporary worldview of solutions to problems in traffic and transport. (Table.2.).

The question arises, how can we find travel companions?

Above all, this initiative must be institutional with a legal basis that would encourage the use of this strategy. Carpooling is a strategy that applies to people traveling to the same destination or area such as schools, companies or organizations and could further be supported or maintained by companies through online platforms such as websites and social media platforms like the Facebook page - <https://www.facebook.com/groups/voztitja/> - which has a significant number of followers and citizens that are looking for a travel companion to the same destination.

The best way to find travel companions is by asking neighbors if they share the same route, or using social media to advertise the route you'll be sharing and the final destination, or posting an ad on neighborhood message boards or even create flyers and distribute them in your neighborhood. (Kellogg, 2021).

By implementing this strategy, a part of the traffic is eliminated from the congested corridor and the remaining traffic becomes regular and flowing after passing the artificially created narrowness (Kizolli, 2019).

Several US governments have started programs to provide carpooling opportunities and provide various forms of subsidies and incentives to people who carpool, that being said could be the case for Pristina to also providing subsidies or different incentives for these people (Kellogg, 2021). Stimulations can be: the reduction of the price of derivatives for vehicles used for carpooling, the reduction of the price for vehicle registration, the possibility of using the bus lane, the possibility of using the public parking lots outside the Barracks with certain hours, etc. All this can happen by equipping them with a special card which shows that the vehicle in question is a vehicle intended for carpooling (Kizolli, 2019).

When choosing the vehicle for carpooling, we must consider that the driver has to be equipped with a valid driver's license according to the relevant category and have the vehicle registered along with valid insurance, as well as the choice of the vehicle with lower fuel costs, desired comfort and sufficient space for traveling together, and at the end of the day, have the card that shows that you are developing a traveling together according to the rules that must be determined by laws and regulations. The main condition of traveling with the vehicle of one of the fellow passengers remains the division of financial expenses starting from the cost of derivatives, then the depreciation of the vehicle and the maintenance of the vehicle for the time you are traveling together, as well as all these expenses must be calculated and divided for number of passengers, and deadlines must be set for these payments so that there is no case for manipulation. In addition to the division of expenses, the details such as smoking and eating during the time of travel should be regulated by law or regulation since some of the fellow travelers may be hindered by these actions (Kellogg, 2021).

So, from all the points mentioned above, the carpooling strategy can be shown as a very favorable solution. In the current situation at the KSF parking lots the overall capacity of 330 parking spaces is exceeded as the demand for parking of private vehicles is around 400. With the implementation of the carpooling strategy by KSF members, which is shown to be acceptable based on the survey, the number of vehicles in KSF parking lots would drop significantly (Table 2 and 3). Through a simple analysis it can be calculated that if 4 members would travel in one vehicle then 125 vehicles would be needed to cover the journey of all members, however considering that this possibility is less preferable then we can take the average of 3 members in one vehicle and 167 vehicles in total that would be needed to cover the journey for all members of KSF. This would positively affect the financial situation of the members by reducing the expenses of travel and maintenance of the vehicle and instead of maintaining 3 or 4 vehicles they can maintain one vehicle together which would be a great help and financial relief (Tables 2 and 3).

Then it would also affect the social life of the members where it would create even more social closeness between them, and it would reduce the number of vehicles in the KSF parking lots where the alternative parking lot would not need daily use but only in particular cases, as well as it would affect the reduction of the number of vehicles in traffic, where instead of 400 vehicles, the number of vehicles would be reduced to 125 or relatively to 167 vehicles, which would be a great help, especially during the peak hours between 07:00 -08:00 and 16:00-17:00. (Kizolli, 2019). Based on a simple analysis, we can conclude that the carpooling strategy is a good and contemporary choice that offers good opportunities for travel and solutions to other problems related to travel in general. From the conducted survey, the total number who stated that they accept a companion is 229 respondents, while the number of negative answers that do not accept a companion is 33 respondents, which gives us an indication that the method of companionship can be a very good and favorable for reducing the number of vehicles in traffic, which would directly contribute to the surrounding municipalities (Table 2).

Taking into account the results obtained from the surveys, it appears that 115 respondents travel with private vehicles, while 50 respondents stated that they travel with urban transport (Table 2). If we look at the total number of members and employees who serve in the "Adem Jashari" barracks in Pristina and the responses received from the survey, then we see a high number of people commuting to work with personal vehicles and a continuous increase in demand for spaces designated for parking within the premises of barracks. However, if the co-passenger method were to be put into action as most of the respondents have stated that they prefer this solution, this would lead to a noticeable decrease in the number of vehicles in traffic, and especially in demand for parking spaces inside the "Adem Jashari" barracks (Table 2).

Now, taking the analyzes made above, it appears that traveling together has a very high impact on the social life of the members and employees who serve in the "Adem Jashari" barracks in Pristina, as it would create greater closeness between the members where they would have more

time to spend together, as well as it would have a positive effect on the financial situation by lowering the fuel costs and vehicle maintenance, and the reduction of environmental pollution (Table 3).

5. CONCLUSION

This study shows that the municipality of Pristina needs proper planning and management of transport. Based on the survey, we have come to the conclusion that a significant number of members who travel with private vehicles see carpooling as a very good choice, as they think they have the opportunity to socialize with each other and save money, as well as it would reduce the number of vehicles in traffic and the demand for parking spaces in the "Adem Jashari" Barracks, which would be a help for the institution itself financially as there would be no need for investment to create new parking spaces and cover the requirements for a parking space. However, if we refer to the existing situation, we can see the analyzes and comments about the advantages and shortcomings, pointing out to be the best opportunity for traveling together as a strategy to be implemented among the members of the Kosovo Security Force who serve in all the Barracks, as well as it would also be a good opportunity for other institutions to adopt such a model and reduce the flow of vehicles, by creating a special regulation for connections, which concretizes the incentives and reliefs for people who use this travel strategy.

Based on the existing situation and the will of KSF members expressed through surveys, we can give the following recommendations:

- Comprehensive research for the implementation of the shared travel strategy within the Municipality of Pristina.
- Drafting the regulation for the implementation of the shared travel strategy within the Municipality of Pristina.
- The inclusion of the following incentive-punishment measures for carpooling users:
 - The right to use special bus lanes.
 - The right to use public parking lots within the Municipality of Pristina. Outside working hours but within a limited period.
 - Determination of prices for fellow passengers.
 - Organization of parking lots within the institutions, in this case including a fee in the barracks, except for cars that are part of the carpooling strategy.
- Promoting the carpooling strategy and investment in the creation of the carpooling culture.
- Creating websites promoting carpooling as the main topic, where they would provide information to citizens about the carpooling method as well as provide a communication platform to ensure carpooling.

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A STUDY ON THE USE OF FURNACE SLAG, FLY ASH AND CALCINED CLAY AS CEMENTITIOUS MATERIALS

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Abstract. Materials with a certain binding capacity have been decisive in the development and evolution of construction. This evolution has led to Portland cement and reinforced concrete being the most widely used materials in the construction industry. On the other hand, the cement industry is one of the main sources of CO₂ emissions. Consequently there is a need for alternative binders with cementing capabilities, which do not harm the environment and can also bring benefits, such as fly ash, furnace slag and calcined clay. These materials can be used as mineral additives in the preparation of Portland cement, as additives in grinding or in the mixture of two or more fine materials that partially replace Portland cement. In this paper, the compressive strength of the mortars prepared with furnace slag, fly ash and calcined clay, coming from different deposits of Albania, was tested after 2, 7 and 28 days and the results were compared with that of OPC concrete (CEM I 42.5 R).

Keywords: Alternative binders, Clinker, Fly ash, Furnace slag, Calcined clay, Compressive strength, Ordinary Portland Cement.

1 Introduction

The cement industry is one of the main sources of CO₂ emissions. It is estimated that CO₂ emissions into the atmosphere reach a value of 1 ton of CO₂ per ton of clinker, so Portland cement contributes to about 5% of global CO₂ production [1]. For this reason, researches are carried out to find alternative materials with cementing capabilities, which do not harm the environment due to their origin and that when used carefully can bring benefits [2]. There are some industrial wastes, which can be used as cementitious materials. There are also other cementitious materials of natural origin (like volcanic ash), which can be used in the concrete mix. Today, over 80% of supplementary cementitious materials used to reduce the clinker factor in cement are: limestone, fly ash, wood ash, fumed silica, furnace slag (from the metallurgical industry), metakaolin (from calcined clay) and shale [3]. These materials can be used as mineral additives in the preparation of Portland cement, as additives in grinding or in the mixture of two or more fine materials that partially replace Portland cement. Below, some of these supplementary cementitious materials will be treated separately [4].

Fig. 1. Supplementary cementitious materials.

A cementitious byproduct is a secondary material derived from an industrial production process that possesses conglomerative characteristics after a certain treatment [2]. These materials, that are considered as waste, may possess or have a certain adhesion capacity and may be useful or marketable when they find application in another industrial sectors, for example, as partial replacement materials in Portland cement, as is the case of granular slag. There is currently a high interest in the application of this material in the production of cement to reduce the amount of CO₂ released into the atmosphere. Furnace slag has cementing characteristics, which can be used to produce a special type of cement. Replacing part of the clinker with slag is currently applicable and brings several benefits, for example, improvement of the compressive strength. The scale of improvement will depend on the amount of slag as well as the exposure environment of the concrete [5].

The physical and mechanical properties are very important and determine the suitability of concrete for use. The main characteristic of concrete, which is affected by the use of cementitious materials of natural origin, is resistance to compression. Under different mixtures, conditions, origin, or atmosphere, the use of a certain amount of these materials is allowed without significantly affecting the mechanical properties of concrete [1], [5], [6]. The main objective is to review the situation on the trends of concrete compressive strength.

Granulated furnace slag is a non-metallic, fine glass by-product (finer than Portland cement), with a specific gravity lower than that of ordinary cement, and a longer hydration time compared to Portland cement [7]. Physical properties of granulated furnace slag, reported by several authors [9], [10], [11], are given in table 1. In terms of chemical content, this by-product is composed of silicates, calcium aluminosilicates and other phases. Therefore, its components are similar to Portland cement oxides, but in different proportions [8]. The typical chemical composition of granulated furnace slag reported by several authors [9], [10], [11], is given in table 2.

Table 1. Physical properties of granulated furnace slag.

Physical Property	Tasong et al. (1999)	Onër and Akyuz (2007)	Hui-sheng et al. (2009)
Specific gravity	2.9	2.87	2.89
Specific surface area (m ² /kg)	425-470	425	371
Density (kg/m ³)	1200	-	-

*[Tasong et al (1999), Onër and Akyuz (2007), Hui-sheng et al.(2009)] [9], [10], [11]

Composition (%)	Tasong et al (1999)	Onër dhe Akyuz (2007)	Hui-sheng et al (2009)
SiO ₂	35.34	39.18	36.39
CaO	41.99	32.82	30.13
Fe ₂ O ₃	0.35	2.02	2.44
Al ₂ O ₃	11.59	10.18	13.76
MgO	8.04	8.52	9.36
SO ₃	0.23	-	1.3

Table 2. The chemical composition of slag.

*[Tasong et al (1999), Onër and Akyuz (2007), Hui-sheng et al.(2009)] [9], [10], [11]

One of the future development options is to increase the use of industrial by-products [12], such as municipal solid waste ash. If the waste has binding properties, then the use of Portland cement clinker can be reduced, which is beneficial to the environment due to reducing CO₂ gas emissions

[13], [14], [15]. Incinerator ash often consists of fine fly ash, and bottom ash, which is usually a denser material that remains in the incinerator after combustion. The bottom ash is mainly composed of amorphous silica, alumina (Al_2O_3), iron oxide (Fe_2O_3), calcium oxide (CaO) and is similar to slag, which is used as a substitute in cement [16]. Also, this mineralogical content is analogous to the mineral mixture used in Portland cement. Other components, such as chlorides, alkalis, trace metals can change the hydration properties, mechanical strength and reactivity of cement products [17], [18]. Ash cement contains about 10% more C_3S than ordinary cement, which is the phase mainly responsible for the development of resistance and heat generation during the first 28 days of hydration. The higher C_3S content results in more heat in the first days, faster setting time, and in a concrete with higher compressive strength in the first days compared to Portland cement. The mechanical properties are favored when the percentage of ash replacement is within certain limits [19]. Beyond them, the resistances in compression and bending decrease gradually with the increase of the ash content [20].

On the other hand, the only type of material which is available in the quantities needed to meet the demand is clay and its combination with limestone allows replacement of up to 50% of clinker, having the same mechanical properties as well as improving the stability of concrete [21]. The reactivity of the calcined clay depends on the kaolin content in it [22]. A kaolin content of about 40% in a mixture of LC₃-50 (50% clinker, 30% calcined clay, 15% limestone, 5% gypsum) is sufficient to give mechanical properties comparable to those of ordinary Portland cement [23], [24]. Such clays are widely available in the equatorial and subtropical parts of the world. In terms of investment and production cost, the latter is similar to the cost of Portland cement [25]. Technologically, it has been proven that it is able to economically produce cement with a quality comparable to that of Portland cement. It does not require a large investment in equipment and can be easily integrated into the cement production process [26].

2 Materials and methods

This section describes the experimental study of the elemental composition and compressive strength of different samples with slag, ash and calcined clay. The main purpose is to determine the compressive strength of the samples formed with the above-mentioned materials and their comparison with ordinary Portland cement.

2.1 Materials collection

Several samples were taken for analysis and the sampling site is as follows:

- The ash samples were taken in the municipal solid waste incinerator, in the city of Elbasan, Albania.
- The slag samples were taken at the ferro-chrome plant and at the steel production plant ("Kurum"), in Bradashesh, Elbasan, Albania.
- The clay samples were taken in the clay quarry near the Cement Factory in Fushe-Kruja, Albania.

2.2 The XRF analysis of the samples

The samples taken for analysis were respectively fly ash, bottom ash, calcined clay, slag taken from the Ferro-chrome industry, white slag taken from the "KURUM" factory and black slag taken from the "KURUM" factory, in Elbasan, Albania, fig.2). The XRF analysis procedure for

these materials was carried out in the apparatus illustrated in figure 3. The principle of this procedure is to create curves for different applications with raw materials of different chemical composition, in order to create curves of dependence between the concentration of the oxide of interest and the number of voltage drops/second (kcps - kilocounts per second) coming from the sample. The creation of curves is performed by the software of the device - SuperQ based on the least squares regression method.

Fig. 2. Sample illustration taken for analysis, a). fly ash, b). bottom ash, c). calcined clay, d). slag taken from the Ferro-chrome industry, e). white slag taken from "KURUM" factory and f). black slag taken from "KURUM" factory, Elbasan, Albania.

Fig. 3. XRF apparatus (SDD detector).

2.3 Clay calcination procedure, prism formation and compressive strength analysis

For the clay calcination procedure, a sample weighing 5 kg is selected according to the sample selection procedure in the ECF laboratory. It is then dried for 12 hours in a thermostat at a temperature of 110 °C. After drying, it is ground in a laboratory mill. 20 g of ground clay are taken and placed for 1 hour in the MUFFEL for calcination at 800 °C.

Briefly, the procedure for the formation of prisms and the analysis of compressive strength is described below. The samples consist of 450 ± 2 g of cement, 1350 ± 5 g of sand and 225 ± 1 g of water. Initially the cement is mixed with water and then sand is added. The prisms are 40 mm x 40 mm x 160 mm in size and are stored in water baths at (20.0 ± 1) °C [27]. The prism must be placed in the press (class 1,50-250 KN according to EN 7500-1 [28], accuracy ± 1.0 %, speed of loading 2400 ± 200 N/s), which is loaded with a speed of 2400 ± 200 N / s and by means of automatic pressing the prism is broken. The result expressed in MPa is then read ($1\text{MPa} = \text{Exercised force} / \text{surface in mm}^2$).

Fig. 4. Laboratory mill with disks; bathtub where the prisms are kept; hydraulic press.

3 Results

3.1 The elemental composition of the samples (XRF results)

The results of the elemental composition of the ash, slag and calcined clay samples are shown respectively in tables 3 and 4 and presented graphically in fig.5 and 6.

Table 3. Elemental composition results for ash and slag.

	MgO %	Al ₂ O ₃ %	SiO ₂ %	CaO %	TiO ₂ %	MnO %	FeO %
Ferro-chrome slag	10.23	6.473	15.85	1.275	0.1	10.32	0.26
Bottom ash	9.44	4.34	10.54	41.11	1.025	0.624	1.9
Fly ash	7.1	0.21	1.25	56.03	0.26	0.0589	0.00013
Black slag “Ku- rum”	9.922	12.61	20.91	38.91	0.72	11.24	12.95
White slag “Kurum”	9.63	11.34	21.77	45.66	0.51	1.861	10.73

Fig. 5. Elemental composition of slag and ash samples.

From the elemental composition analysis of these five samples, it is observed that the richest sample with the three main oxides (calcium, aluminum and iron oxide), is the white slag “Kurum”. The sum of the content of these oxides is close to 70%, which means that the material taken in study exhibits high potential to have positive compressive resistance results.

Table 4. Elemental composition results for calcined clay.

Oxide	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	SO ₃	LOI
%	64	12.5	7	2	0.7	0.24	10.4

Fig. 6. Elemental composition results for calcined clay.

Furthermore, from the results obtained for the elemental composition of the clay, we notice that the content of the main oxides such as CaO, SiO₂, Al₂O₃ and Fe₂O₃ is to some extent high. Therefore we expect positive results of the compressive resistance.

3.2 The compressive strength results

The results of the compressive strength for the slag, ash and calcined clay samples after 2 and 28 days are given respectively in the following tables.

3.2.1 Compressive strength results for the slag samples

Table 5. Compressive strength results for the cement sample made with slag obtained from the Ferro-chrome factory (MPa).

	Type	2 days	28 days
Compressive strength (MPa)	Cem I 42.5 R FK (control sample)	27.4	49.25
	70 % Cem I 42.5 R FK + 30 % (Ferro-chrome) slag	18.3	33
% of Resistance given compared to the control sample	70 % Cem I + 30 % slag vs Control Sample	66.85	67.25

Fig. 7. Compressive strength for CEM I 42.5 R and 70 % Cem I 42.5 R FK + 30 % slag (Ferro-chrome).

That which is observed from the results obtained for the sample with 30% ferro-chrome slag, is that the resistance after 28 days reaches 33 Mpa. Comparing it with the result obtained after 28 days for the control sample, what we see is that the percentage of resistance compared to it, reaches approximately 68%. This result did not meet expectations, because in this case, the minimum resistance obtained had to be 42.5 Mpa, in order to reach the cement mark.

Table 6. Compressive strength results in Mpa for black slag obtained from "KURUM" factory.

	Type	2 days	28 days
Compressive strength (MPa)	Cem I 42.5 R FK (control sample)	26.4	48.1

	70 % Cem I 42.5 R FK + 30 % "Kurum" Black slag	14.1	30
% of Resistance given compared to the control sample	70 % Cem I + 30 % Black slag vs Control Sample	53.4	62.4

Fig. 8. Compressive strength for CEM I 42.5R and 70% Cem I 42.5 R FK + 30% black slag from "KURUM".

Comparing ferro-chrome slag with black slag, the latter has weaker results. After 28 days, its compressive strength is approximately 63% of the resistance of the control sample. Even in this case, we can say that this result did not meet expectations because the cement mark (42.5 Mpa) is not reached.

Table 7. Compressive strength results (Mpa) for white slag cement samples.

	Type	2 days	28 days
Compressive strength (MPa)	Cem I 42.5 R FK (control sam- ple)	26.4	48.1
	70 % Cem I 42.5 R FK + 30 % "Kurum" white slag	18	42
% of Resistance given compared to the control sample	70 % Cem I + 30 % white slag vs Control Sample	50.4	75.9

Fig. 9. Compressive strength for CEM I 42.5R and 70% Cem I 42.5 R FK + 30% white slag from "KURUM".

The results of the white slag are distinctly higher compared to the previous slag samples. In this case, the percentage of resistance compared to the control sample reaches approximately 76%. Considering also the results of its elemental composition, a distinctly better result than the previous cases was expected. The compressive strength after 28 days is 42 Mpa, very close to the required 42.5 Mpa. The results were relatively satisfactory, however, further studies should be carried out to optimize the use of this type of slag in the cement samples.

3.2.2 Compressive strength results for the ash samples

Table 8. Compressive strength results (MPa) of the bottom ash (BA) samples (Elbasan incinerator).

	Type	2 days	28 days
Compressive strength (MPa)	Cem I 42.5 R FK (control sample)	26.4	48.1
	70 % Cem I 42.5 R FK + 30 % brown BA	10.7	28.4
% of Resistance given compared to the control sample	70 % Cem I + 30 % brown BA vs Control Sample	40.5	59

Fig. 10. Compressive strength for CEM I 42.5R and 70% Cem I 42.5 R FK + 30% incinerator fly ash.

In the case of brown bottom ash, what we observe is that the results are much weaker compared to the previous cases and significantly weaker compared to the control sample (42.5 Mpa), which was up to a point expected based on in the elemental analysis of this sample. The percentage of resistance achieved by the sample with 30% brown bottom ash is 59% of the resistance of the control sample.

Table 9. Compressive strength results (MPa) of white fly ash (FA) sample (Elbasan incinerator).

	Type	2 days	28 days
Compressive strength (MPa)	Cem I 42.5 R FK (control sample)	26.4	48.1
	70 % Cem I 42.5 R FK + 30 % white FA	14.4	35.4
% of Resistance given compared to the control sample	70 % Cem I + 30 % white FA vs Control Sample	54.5	73.6

Fig. 11. Compressive strength for CEM I 42.5R and 70% Cem I 42.5 R FK + 30% white fly ash.

From the results obtained for the white fly ash, it is observed that the percentage of resistance compared to the control sample is approximately 74%. The resistance reached by the sample with 30% fly ash after 28 days is 35.4 Mpa, relatively far from the expected result to reach the cement mark.

3.2.3 Compressive strength results for the calcined clay samples

Table 10. Compressive strength results for cement samples with 30% calcined clay.

Sample	Compressive strength [MPa]		
	2 days	7 days	28 days
CEM I 42.5R	27.3	40.5	53.3
Calcined Clay 30%	-	22.4	42.5

Fig. 12. Compressive strength comparison of sample 1 (CEM I 42.5 R) and sample 2 (containing 30% calcined clay) after 2,7 and 28 days.

The percentage of resistance achieved by the sample with 30% calcined clay, compared to the control sample, is approximately 79.8%. The results of the clay can be said to be satisfactory, since the resistance achieved by the sample with 30% replacement after 28 days is 42.5 Mpa, a value that indicates the achievement of the cement mark.

3.2.4 Compressive strength comparison of all samples taken in study

Fig. 13. Comparison of compressive strength for all samples taken in the analysis.

What was noticed from the obtained results, is that based on the elemental composition of different samples we can, to some extent, predict the results that will be obtained during the compressive resistance analysis. Precisely this was verified by obtaining the results of compressive resistance, where it was clearly observed that the samples with calcined clay and white slag from "KURUM" were more effective. This is also verified by the above comparison chart where the 2 and 28 day compressive resistances of all the samples with 30% replacement are shown. The replacement percentage of the cement samples with the materials taken in the study was arbitrary chosen to be 30%. However, further studies can be carried out to try different replacement percentages in which more satisfactory results can be acquired.

4 Discussions

There are some arguments for the results obtained from the conducted experiments. Regarding the slag samples, slag hydrates more slowly compared to ordinary Portland cement. Considering this, it is believed that the characteristics of the hydration process are a conditioning factor for the development of resistance. Moreover, the strength of concrete samples containing crushed furnace slag is related to the surface and distribution of the slag particles. For the same specific surface, with the increase of fineness, the strength of the concrete also increases. The effect of the specific surface area as well as the fineness of slag may have affected the results, so they should be further studied. Also the level of slag in the concrete mix can have a beneficial effect in its mechanical properties, but this is conditioned by a certain degree of substitution. The previously mentioned proportions of the oxide compounds will determine the basicity of the slag and its hydraulic capacity. However, for the slag to be able to truly develop its hydraulic potential, it is fundamental that its vitreous phase is largely superior to 70%. This vitreous characteristic will condition the ability of the slag to recreate the crystalline structure that will provide the concrete with its resistance and durability qualities. The beneficial effects of the slag on the mechanical properties of the concrete will be in accordance with different factors, among which stand out the quality of the slag, the mixture design, as well as the type and curing time.

As for the municipal solid waste ash, the overall results in our case do not support the use of this material with a 30% replacement percentage. In the case of ash, its chemical composition may be the main reason for these results. The high percentage of CaO compared to the other oxides and the non-uniform fineness of the clinker and this cementitious material has led to an inefficient hydration reaction. Similarly to slag, the mechanical properties are favored when the percentage of ash replacement is within certain limits. Beyond them, the resistances in compression and bending decrease gradually with the increase of the ash content.

Concerning the calcined clay, better results were obtained. During calcination, the hydroxyl bonds between the clay structures undergo a reorganization of the basic building units, thus, resulting in a highly amorphous material. This clay structure contributes to an increase in the specific surface area of the cementitious mixture and a finer porous structure than that of ordinary cement. In our case, it is claimed that the amount of kaolin mineral is low, producing a small amount of metakaolin during calcination, and therefore its efficiency is low. Metakaolin reacts with $\text{Ca}(\text{OH})_2$ to give calcium silicate hydrates, which are products that contribute to the development of mechanical properties of concrete. In addition, it is also thought that both the temperature and the calcination time may have influenced the results.

5 Conclusions

After performing the analyzes for all the samples taken in study and after receiving the relevant results, the following conclusions are reached:

- The cementitious materials studied are a real potential for replacing cement in concrete if they present pozzolanic properties and have a content of 3 oxides ($\text{CaO} + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3$) in values close to 70%.
- For the sample of fly ash and bottom of the incinerator of Elbasan, metallurgical slag in the area of Elbasan (Ferro-Chrome and Kurum), as well as the clay taken in Fushë-Kruja for analysis, we had a decrease in resistances for replacement rate of 30%.
- In the case of ash and slag, their chemical composition may be the main reason for these results. The high percentage of CaO compared to other oxides and the non-uniform fineness of the clinker and these cementitious materials have led to an inefficient hydration reaction.
- Although the values of the compressive strength results were low, the best results were obtained for clay. In this case, it is claimed that the amount of kaolin mineral is low.

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Possible alternatives for sustainable transport in Pristina, Kosovo

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Abstract

Purpose – The purpose of this research is to look for possible ways to reduce the challenges of daily traffic and the environmental impact of transport in Pristina by suggesting more environmentally friendly methods. There will also be an analysis of the current situation, the decisions and proposals undertaken and the behavior of people on the measures proposed by the Municipality of Pristina.

Design/methodology/approach – The present study uses a qualitative research method and inside and outside interviews as a research instrument. The present study interviews around 15 experts in urban and spatial planning, traffic engineering, architecture and geography.

Findings – The study finds that transport situation in Prishtina does not meet mobility requirements as a result of deficiencies in coverage, frequency, resources and infrastructure. The study further finds that the number of old and not environmentally friendly is high, some of the roads and roundabouts were not done correctly with a proper analyze and the lack of adequate staff and budgeted impact on the improper management of the traffic infrastructure. The study also finds that there is an emergent need for awareness on using alternative methods of the transport in Prishtina. The behavior of our citizens, who use the car even without much need for it and where the possibility of alternative transport, such as public transport, is very present.

Research limitations/implications – The present study helps researchers and citizens to understand the current system of transport and the daily challenges in the urban context, in order to develop more knowledge about the gaps that need to be filled with new researches. Furthermore, this paper aims to collect success stories that research has shown to work in cities in different contexts and can be applied in other urban contexts.

Originality/value – The study contributes to the current knowledge about the developments of the transportation in Kosovo. The findings will identify future developments on the urban context of possible sustainable transportation alternatives in Kosovo.

Keywords: Sustainable Transport, Modern Infrastructure, Quality of Life, Emissions, Impact on Health, Environment, Infrastructure, Current Situation, Challenges, Strategic Planning, Future Development.

1. Introduction

Interest in sustainable development and sustainable transportation has grown rapidly in the first 10 years of the millennium due to the environmental, social and economic impacts that these sectors have on communities, regions and Earth (Mitropoulos and Prevedouros, 2016).

Sustainable transportation involves applying the concept of sustainable development to the planning and development of transportation infrastructure (Wey and Huang, 2018).

The transport situation in Prishtina is not so pleasant. Dense traffic, large number of cars, difficulties in the movement of citizens and air pollution are some of the indicators that lead us to a devastating phenomenon of sustainable living in the city. This is one of the reasons that Prishtina is looking for a new transport system and this will be one of the biggest challenges that the city will have.

We face the challenge of pollution every day and every year we are labeled one of the most polluted cities in Europe. Sustainable solutions and quick decisions are very necessary to be undertaken in the city of Prishtina.

The development of a sustainable integrated public transport system is at the heart of the strategy, which aims to improve access throughout the city and improve the connection between other urban decisions in partnership with public transport providers and private investors.

The implementation and operation of this system is not going to be easy. Is the “bad urban growth” of the city the cause or are the people themselves and their behavior and mentality the cause?

It is argued that using a car is very attractive and sometimes even necessary for many different reasons. This implies that a combination of policies is required, each targeting different factors that support car use and discourage the use of more sustainable methods of transport. The acceptability of such policies can be increased by clearly communicating the purpose of these policies and the expected positive consequences (e.g. less congestion, improved environmental quality). Moreover, possible negative effects on individual freedom can be offset by implementing additional policies aimed at facilitating the use of sustainable methods of transport (Steg, 2014).

When talking about initiatives and new development, one should always consider the reception of these initiatives based on the behavior of the Prishtina’s citizens.

The purpose of this research is to look for possible ways to reduce the challenges of daily traffic and the environmental impact of transport in Prishtina by suggesting more environmentally friendly methods. The suggested methods come from the results of our interviews and are methods used in different countries of the world and tested. There will also be an analysis of the current situation, the decisions and proposals undertaken and the behavior of people on the measures proposed by the Municipality of Prishtina.

2. Literature Review

Although rapid socioeconomic development has accelerated world urbanization and advanced technological progress to shape the today or even tomorrow cities (Newman, Beatley, & Boyer, 2009; Newman & Kenworthy, 2015), it has also placed a sizeable burden and destruction on the urban sustainability and livability. Previously, in order to create an urban ideal environment, Jane Jacobs, a great and extremely famous urban scholar advocated the avant-garde concept of human-scale and the beauty of urban smallness to facilitate the cities more livable and habitable (Gans, 2006; Laurence, 2006).

To evaluate sustainability in urban areas the interaction between all the activities developed in the city and their relevant impact in the environment, in the society and in the urban economy must be taken into account. At first, the main objective is to reduce environmental impacts, but it is important to observe if the implementation of some measures that minimize those problems simultaneously motivates a regression in a few urban economy indicators and decreases the population life conditions. Therefore, the main difficulty in urban areas is the implementation of measures that can reduce environmental problems and at the same time maintain a practical development in the urban economy. Concerning this aspect, the efficiency of urban transport systems is very important in the maintenance of the urban economy, nevertheless some systems can produce several environmentally negative impacts. Thus, it is important to evaluate the urban transport system in order to adequate it to urban mobility system for a real sustainable urban development (Campos et al., 2009).

The sustainable development is usually evaluated in three main dimensions: Environment, Society and Economy, and each dimension must not be analyzed independently. For each one of these three dimensions some important impacts can be associated with the urban transports systems:

- in the environment context: air pollution, noise, water contamination and natural resources consumption;
- in the social context: health, equality and justness of opportunities;
- in the economic context: regional and urban economy, transports cost, competitiveness and subsidies (Campos et al., 2009).

Sustainable mobility is one of the crucial components for a city sustainable development and it can be achieved through measures that ease the population displacement in order to improve the quality of life and to promote an efficient consumption of natural resources. In order to evaluate sustainable mobility, it is necessary to design an evaluation procedure based on transport and land usage

indicators related to the urban development and to the sustainable dimensions (Campos et al., 2009).

Next, the final section of literature review elaborates the importance and impact that sustainable transport will have in health and lifestyle of Prishtina's citizens.

The importance of multiscale and integrated strategies, in order to achieve green, inclusive and sustainable cities intend material and immaterial networks as infrastructures and common goods that can strengthen resilience toward the achievement of beautiful, sustainable and inclusive cities. The situation related to COVID-19 has pointed out the importance of public space, green networks and soft mobility, as also fostered by the SDGs and by the new European Bauhaus. Thanks to the special awareness of authorities and citizens, regeneration processes can contribute to this paradigm shift toward healthier cities, based on sustainable lifestyles for environment and people (Ravagnan et al., 2021).

Air quality is crucial to the health and quality of life of people. Transportation waste emissions are a major cause of urban air pollution (Wey and Huang, 2018).

In the most recent period, Zhan et al. (2018) conducted a large-scale questionnaire survey on 40 major cities in China in order to fill the gaps of past studies for urban livability. The results show that the six dimensions of urban livability (including public facilities, natural environment, socio-cultural environment, urban security, environmental health, and convenient transportation) have significant and positive impacts upon overall satisfaction with urban livability, of which the natural environment, convenient transportation, environmental health are the greatest contributing factors (Wey and Huang, 2018).

To support the transition to cleaner, greener, and smarter mobility, in line with the objectives of the European Green Deal, the Commission today adopted four proposals that will modernize the EU's transport system. By increasing connectivity and shifting more passengers and freight to rail and inland waterways, by supporting the roll-out of charging points, alternative refueling infrastructure, and new digital technologies, by placing a stronger focus on sustainable urban mobility, and by making it easier to choose different transport options in an efficient multimodal transport system, the proposals will put the transport sector on track to cutting its emissions by 90% (European Commission, 2021).

Next, as a consequence of well-elaborated literature review, the present study formulates the following research questions:

1. How do you evaluate the current situation of transport in Prishtina?
2. What are the sustainable transport alternatives in Prishtina and how can they be implemented?
3. What would be the challenges in their implementation?
4. How would they affect the improvement of living conditions for citizens?

3. Research method

The present study uses a qualitative research method and inside and outside interviews as a research instrument. Considering that experts can be the ones who give more concrete answers, it was the reason for this paper to be related to the qualitative method.

The qualitative research technique is more intrusive technique and less structured as quantitative method, which enables the interviewer to gain in-depth insight regarding the research topic (Jarratt, 1996). The qualitative method provides the intricate details of phenomena, which cannot be derived through quantitative methods (Strauss and Corbin, 1990). The qualitative method, on the other hand, deals with the phenomena that include quality, and that in our paper, opens the way for a more concrete study and the extraction of the desired results.

The inside and outside interviews were held physically and some others by sending questionnaire on the email.

1. Research instrument

A research instrument is a tool that collects data dedicated to a study. They include a wide range of research methods. The success of the work depends on the reliability and also on the validity of the data. Considering the importance of the work, all the data should be analyzed deeply to get a desirable result.

The interview was composed of three parts. First part of the interview concerns the current situation of transport in Prishtina and was composed of one general question. Second part of the interview addresses the proposed sustainable transport alternatives from the respondents, what challenges would have these proposed alternatives during the implementation and was composed of three questions. Finally, the third part of the interview concerns the impact that these sustainable transport alternatives would have in the citizens health and lifestyle and was composed of one general question.

2. Research sample

The present study uses the purposive sampling as a nonprobability sampling technique for the purpose of qualitative interviews. The present study interviews around 15 experts in urban and spatial planning, traffic engineering, architecture and geography.

The names of the participants were coded. The present study uses the purposive sampling as a nonprobability sampling technique for the purpose of qualitative interviews. The homogenous purposive sampling was selected to choose research participants. The respondents in question represent different sectors in Kosovo such as public sector and academia.

Table 1 presents the types of respondents, code numbers, profession, education, employment sector, age group and gender.

4. Research results

The present section elaborates on the predominant opinion of respondents related to each interview question. The thematic data analysis is used to identify the emerging themes for detailed analysis pa patterns of respondents' answers. Further, the verbatim extracts of interviews are used to discuss and support the themes.

Concerning the first interview question which is "How do you assess the current situation of transport in Pristina?", it is the predominant opinion of respondents that currently the transport in Prishtina does not meet mobility requirements as a result of deficiencies in coverage, frequency, resources and infrastructure.

To learn more about the proposed alternatives for a better and more sustainable transport we made the following question "What are the proposed sustainable transport alternatives in Pristina?", and concluded proposals from respondents were: Redesign of roads and intersections; Design and connection of public spaces; Investing on new buses and designing special roads for buses; New and functional paths for walking and cycling; Parking spaces; Suitable infrastructure for people with disabilities and Concrete measures for traffic safety.

To identify the models how these measures would be possible we made the following sub-question "How they can be implemented?", and we received a more detailed analyzed answer from Respondent 07 saying:

"Implementation on the changed forms of transport (% of use) is realized by applying facilitating policies in the forms which are planned to increase (e.g. public transport by applying the integrated ticket on all lines, recording the kilometers traveled of personal vehicles within years and the payment of road tax in relation to the kilometers traveled, the motivation to use bicycles, the promotion of walking in short distances, the possibility of combining forms of transport: public-walking; cycling-public or even cycling-public-walking)".

RO3/ In order to identify the challenges that these proposed alternatives would have during their implementation, we addressed the following question "What would be the challenges in these proposed alternatives implementation?" and most of the respondents put special emphasis on the lack of funds and the right planning of budgeting for infrastructure, the harmonization of all strategies at the local level among themselves respectively at the horizontal level and to start with inter-municipal cooperation, the harmonization of all strategies with the central level and gradually to change the mentality for mobility from the bottom up, as well as the awareness of citizens for the use of different forms of transport and awareness campaigns for the impact of motor transport (specifically cars) on the environment and our health.

RO4/ In response to the last interview question "How would they affect the ease of movement of citizens and the improvement of living conditions?", all respondents argue that the implementation of these measures would have a very positive impact on improving the lives of citizens, directly influencing the improvement of air quality, reducing traffic stress, freeing up spaces "occupied" by vehicles and turning them into spaces free public access to all citizens.

5. Discussion

Next, the discussion section interprets the results, compares the results with those from previous studies, and discusses the findings' implications for research and practice.

In relation to the current situation of transport in Kosovo, it is the predominant viewpoint of the respondents that transport in Kosovo is very loaded, irregular and not planned properly in many cases. The same opinion it was shared also by the authors of Urban Development Plan of Municipality of Prishtina, who said that roundabouts were not been studied in advance in order to define the design elements for roundabouts, respectively depending on the traffic requirements and the ratios of the size of the circulation, the geometry and dimensions of the roundabout should also be determined. The deficiency of these roundabouts is also considered the fact that in some cases there are discrepancies between the number of lanes in the roundabout and the number of lanes entering and exiting the roundabout, in which case the number of conflict points is increasing during the transition from one lane to another. In the following figure you can see roundabouts of the city of Prishtina.

Figure 1: City roundabouts according to the Strategic Plan

Additionally, it is the predominant viewpoint of respondents of this study that the municipality should invest in new and modern buses and building special path for buses, especially on the city center where the traffic is more loaded. This proposal is based on the Recital 18 of Directive (EU) 2019/1161 that explicitly clarifies that 'trolley buses are considered to be zero-emission buses, provided that they run only on electricity or that they use only a zero-emission powertrain when they are not connected to the grid, otherwise they still count as clean vehicles.

In relation to the impact that the sustainable transport would have in the city the predominant viewpoint of the respondents is that will improve the lives of citizens, will directly influence the improvement of air quality and reducing traffic stress. In the same fashion as the respondents of this study, Michelle, M. (2017) said that particulate matter, hydrocarbons, carbon monoxide and other car pollutants harm human health. Diesel engines emit high levels of particulate matter, which is airborne particulate matter of soot and metal. These cause skin and eye irritation and allergies, and the very fine particles get deep into the lungs, where they cause breathing problems.

Next, as far as key challenges faced on implementation of these proposals are concerned, it is the viewpoint of the respondents that the key challenge is related to inadequate budgets and lack of proper researches, adequate staff and resources to implement adequate transport plans.

6. Conclusions

Based on this study, practices that have been recommended can be used by the relevant institutions, in order to motivate citizens to use these forms of transport. The analysis of the case study of Prishtina also leaves to explore the policy of best practices in the financing of improvements in the current infrastructure to create good

opportunities to use efficient alternative methods. Some conclusions of this study are as below:

- I. The first necessary investment in the Municipality of Pristina is the creation of alternative one-way roads for urban traffic. A one-way street for buses only would motivate people to use public transport and move around more freely.
 - II. The second point that should be invested in public traffic is the introduction of buses with low energy emissions. Hybrid and fuel-efficient buses that will operate in the center of Pristina. Euro VI is the latest standard in diesel engines, reducing NOx emissions by up to 95% compared to the previous generation of buses. The municipality's investment in this new bus line would affect the reduction of pollution.
 - III. "Zero Emission" Hybrids taxis or electrics that will affect the cleaning of Pristina's dirty air. This new system will also integrate fast charging points across taxi ranks and public parking lots to make it easier for these green technology pioneers to get around. The Municipality of Pristina should aim that all taxis and private hire vehicles will be hybrid and electric cars, provide the appropriate infrastructure for their filling and operation and stimulate these companies with tax relief and providing grants from a guaranty fund of the municipality and the government, or funds from the World Bank, Stock Exchange, etc.
 - IV. At each zonal entrance-exit of Prishtina from the regions: Gjilan - Ferizaji, Mitrovica, Prizren - Peja (Dukagjini), Podujeva (Llapi) according to the zonal maps, large parking lots should be built, where citizens from these regions would be able to park their cars and continue using buses to enter into the city of Prishtina. This alternative remains to be discussed with the relevant governmental and municipal bodies, because it requires a special proprietary, financial, economic research for investments in roads infrastructure.

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USING ARC MAP IN THE PROCESS OF EXPROPRIATION

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Abstract

Based on the articles, protocols provided in the Laws, the European Convention, the Constitution of Kosovo, the General Declaration on Human Rights, we conclude that the protection of property rights is guaranteed by the Constitution of Kosovo, the laws of the Republic of Kosovo, European Convention, and the General Declaration on Human Rights, and that private real estate can be expropriated by applying the laws in force, and only when this is necessary for the purpose of developing works of general social interest, and fulfilling the certain conditions such as: the expropriation is done to achieve a legitimate public goal; the immovable property which is the object of expropriation does not have any other purpose or discriminatory intent, and the Compensation must be made fairly, and based on the market value of the immovable property being expropriated.

Kosovo, as a small and not very developed country, has a great perspective in its development based on infrastructure. From the post-war period until today, great importance has been devoted to the development of road infrastructure.

The development of new industries, the construction of buildings, the growth of the population and the changes in its demographic distribution, the increase in the demand for personal transport and many other reasons have brought the expansion or construction of new roads into the center of attention.

Keywords: Parcel, Expropriation, Digitalization, ArcMap.

1. GENERAL INTRODUCTION

GIS (Geographic information system) is a system that creates, manages, analyzes and maps all types of data by linking those data with positional information making their graphical interface as a map. GIS helps users to understand patterns, relationships and geographic context. GIS helps in management systems by increasing the efficiency of work as the generation of changes for GIS is simple and fast.

What is GIS used for specifically:

- Working with maps - You can open and use ArcMap documents to explore information, navigate around map documents, turn layers on and off, search for features to access the rich attribute data behind the map and to visualize geographic information.
- Print maps - You can print maps, from the simplest to the most sophisticated cartography, using ArcMap.
- Compile and edit GIS datasets—ArcMap provides one of the primary ways users automate geodatabase datasets. ArcMap supports full-featured scalable editing. You select layers in the map document to edit, and new and updated features are stored in the layer's dataset.
- Use geoprocessing to automate work and perform analysis - GIS is visual and analytical. ArcMap has the ability to run any geoprocessing model or script, and to view and work with the results through the map visualization. Geoprocessing can be used for analysis as well as to automate many common tasks, such as generating a map book, repairing broken data links in a collection of map documents, and performing GIS data processing.
- Publishing map documents as map services - ArcGIS content is brought to life on the web by publishing geographic information as a series of map services. ArcMap provides a simple user experience for publishing your map documents as map services using ArcGIS Server or ArcGIS Online.

Figure 1 Gis general page (general information)

What is addressed in this study is the use of GIS in the Geodesy Field, specifically in the process of expropriation. Since the post-war, Kosovo has taken a big leap of development and this has led to an increase in major investments. The longest expropriation processes have been taken from the infrastructure but also from the Mines that are still operational. In recent years, it is seen that in order to be closer to European countries, there is a need for investments in renewable energy fields, and one of these investments is Solar Energy (Photovoltaic Parks).

But as you know, these projects are major and require large spaces and suitable positions. These spaces are private land, so the need for expropriation projects arises.

But how would GIS help in these processes?!

This study in general and detailed steps describes the expropriation process using ArcMap 10.5.

2. STEPS OF SOLUTION

1. Project input data.

The study carried out includes a study area between the two municipalities of Obiliq and FushëKosovë, and it is about expropriation according to the polygon of the project for a "Fovoltaic Park"

The input data of the project includes:

- First, the line of the project that will be implemented must be known.
- Coordinates of the reference geodetic grid of the state.
- Certificates on real estate rights
- Orthophotos.
- Vector cadastral plans.
- Measurement sketches for all divisions – subdivisions and
- Actual usage data.
- Geographical and cultural data or destination.
- Other data about the facilities, if any.

These data are known to ARCMAP, and it is possible to incorporate these data into the attribute tables of the corresponding Shape files by combining textual data with graphic data.

To begin with, the project line was changed according to the plots, including or removing from the process the surfaces that make the new plot unusable.

Figure 2 Input data.

2. The process of allocating parcels and creating new parcels

The graphic process of expropriation consists of dividing the parcels affected by the polygon, erasing the old number and creating new numbers.

The parcel allocation process involves two methods in GIS:

1. Making the division manually where the expropriation polygon waits, this method is similar to working through Civil 3D or AutoCadMap
2. Through the automatic method that includes an automatic process of creating new parcels through the ArcMap tool in ArcCatalog

Figure 3 The first procedure of the process of dividing plots according to the expropriation line

The process of dividing the parcels affected by the expropriation polygon using the clip command in arcMap is an automatic procedure, which shortens the time of dividing the parcels and reduces the possibility of errors. But before we execute, we need to turn the plots (leaves) into polygons, which ArcGis did automatically.

*Figure 4 The process of automatic division of polygons
Completion of parcel allocation data*

Figure 5

In this way, it is possible to create new plots and calculate the areas of expropriation automatically through the program.

Figure 6 Expropriation of cadastral plots

3. Control of formed data (TOPOLOGY)

During the creation of new parcels, we made mistakes, as a result, these mistakes must be fixed in order for our work to be accepted.

After checking the general topological rules, the data is recorded. During the data recording process, various errors may appear in terms of their geometry, where we can mention;

1. Within the large plot, there is another plot
2. Not breaking the knot
3. Exceedings
4. Overlaps (do not need more than one line in a partition).

Figure 7 We correct all possible errors.

3. CONCLUSIONS AND RECOMMENDATIONS

After the completion of the graphic part, the division and the relevant corrections, the registers of changes for the plot are drawn up according to the law on expropriation and we will have the register containing:

The old state contains:

- Owner's name
- Parcel number

- Ordinal number
- Culture, Class of the plot
- Plot area
- The changes that were made, the time and when the changes were made.
- Remarks

Likewise, the same data is presented in the new state, only that during the numbering of the new parcels, the last number of the subdivision of the parcel is taken, this is done for reasons not to repeat the same parcel number twice, which is divided into two units and is marked in two columns where one shows the new number of the plot and the remaining area, while the other column shows the new number of the plot and the expropriated area where at the end their collection is done which should be equal to the amount of surfaces before expropriation.

Tabela 1 Log of shifts per parcel

RECOMMENDATIONS

Compared to Autocad, Gis is able to find the mistakes we make during the expropriation process, so it is recommended to use Gis for this process.

Gis gives you the possibility to incorporate in the attribute tables all the information about the plot, from the name of the owner, the text area, Culture/Class, but it gives the possibility to automatically calculate the graphic areas of the plots

So, in short, by means of the ArcMap Program, it reduces time and increases efficiency and improves the visibility of the work

Figure 8 The final map for submission to the relevant institution.

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