ANALYSIS OF THE CURRENT AND FUTURE TRAFFIC ON COUNTY ROAD DJ 665D

SORIN MIHĂILESCU[1], GABRIEL PRAPORGESCU[2]

Abstract: The study of traffic is one of the key support learnings of the feasibility studies, its results leading to the determination of the circulation capacity and to the sizing of the road system. A complete study of traffic gives input data for the economic efficiency analysis and for demonstrating the investment opportunity.

Key words: road traffic, vehicles

1. INTRODUCTION

As for the county and local road networks in Romania (composed of county roads, village roads, adjacent roads and streets in urban and rural localities), the situation is quite dramatic. The main cause is that the administration of public roads is uneven at country level and also because there is no national strategy for its development. The county roads are managed by the County Councils while the other local, village, adjacent roads and streets are managed by Local Councils. Unfortunately, only a few counties have authorized strategies in this domain, while for the Municipal, City and Village Local Councils the situation is even worse.

Traffic data given by CESTRIN (Technical Roads Study and Informatics Center) and results of the traffic national census done every five years are used for building up the prognosis model. The raising prognosis is done assuming the average raise for national, county and village roads.

For this case study we have chosen the county road DJ 665D of 4+740 km, the 0 point being the intersection with DN 67C (Novaci-Rânca-Sebeș) in the city of Pociovalișteand the end point, respectively the km 4+740, being the intersection with DN 67 in the city of Bumbești-Pițic. The route of DJ 665D is in the north-east of the

[1] *Assoc. Prof., PhD, Eng., University of Petroşani, mihailescus@gmail.com*
[2] *Assoc. Prof., PhD, Eng., University of Petroşani, gpraporgescu@gmail.com*

Gorj County, passing through the following cities: Pociovalișteat km 0+000, Sitești at km 1+500 and Bumbești-Pițic at km 4+420 being represented in plan by figure 1.

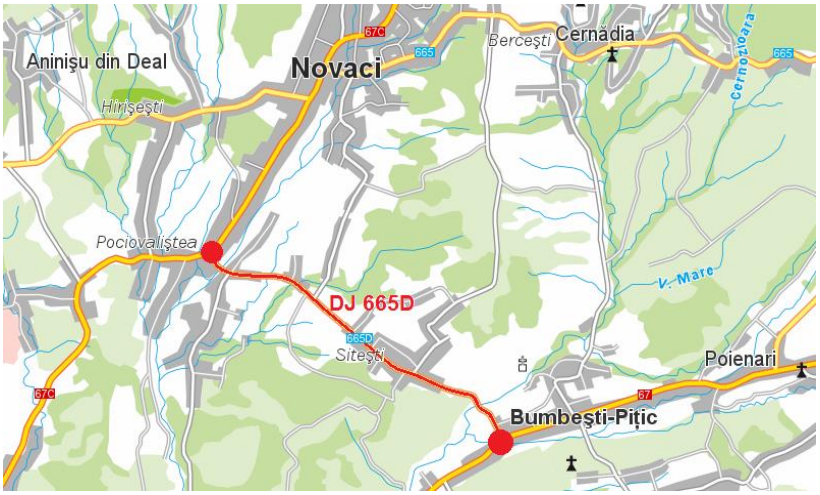

Fig. 1. The county road DJ 665D

2. ABOUT THE CURRENT ROAD TRAFFIC

The technical regulation *"Norms for determining of calculation traffic for designing the roads from the point of view of the bearing capacity and of the traffic capacity"* indicative AND 584-2002 was approved through the Order of the Transport Ministry no. 617 from 23 october 2013, covering the methodology and the used calculation parameters for determining the road calculation traffic for:

- designing and verification of roads regarding the bearing capacity;
- designing and verification of roads regarding the traffic capacity.

The traffic records are done by a pre-scheduled calendar, for ten days, in various periods of the year, respectively – two days in april, two days in may, three days in august, one day in october and two days in november. The road traffic on public roads is recorded by a mixed method – manual-automatic. This method provides permanent automatic records using road traffic counters and manual records on forms.

For DJ 665D there is only one census post, no. 1602 for the km 3+200.

The technical classes are used for the classification of the current public road network for the planification and design of works done for improving and modernizing the traffic conditions but also for the construction of new roads. The technical classification is done independent of inclusion in the functional and administrative categories, considering the intensity of the traffic (table 1) resulted from the data of the latest traffic census. For establishing the technical class of the roads and for their design considering the traffic capacity (the design of geometric elements) the yearly average daily traffic (ADF) is used, actual and potential, expressed in physical vehicles and standard (conventional) vehicles – type auto.

Table 1. **Technical classification of public roads regarding the traffic intensity**

Technical class	Traffic	Traffic characteristics			
		Average daily intensity		Hourly calculation intensity	
		No. of standard vehicles	No. of physical vehicles	No. of standard vehicles	No. of physical vehicles
I	Very intense	>21000	>16000	>3000	>2200
II	Intense	11001-21000	8001 - 16000	1401 - 3000	1000 - 2200
III	Average	4501-11000	3501 - 8000	550-1400	400-1000
IV	Low	1000-4500	750-3500	100-550	75 - 400
V	Very low	<1000	<750	<100	<75

The equalization of physical vehicles into standard auto vehicles is done according to SR 7348-2002 „The equalization of vehicles for determining the traffic capacity", with the Indicative Norm AND 584-2002 „Norms for determining the traffic calculation for road design considering the bearing and traffic capacities" and with the Norm PD 189-2000 „Norms for determining the traffic capacity of public roads", considering the vehicle group and the land characteristics (plains, hills or mountains).

The determination of land characteristics is done according to the Indicative Norm 583-2002 „Norms for determining the land characteristics for road design and for establishing their traffic capacity". According to this norm, the county road DJ 665D is land type – hills.

3. TRAFFIC ANALYSIS

Topologically (the segments and nodes structure which represents the traffic way), the object of the case study is presented by table 2.

Table 2. **The topology of the road DJ 665D**

Road name	Road way	Start km position	End km position	Real length, km
DJ 665D	DN 67C – DN 67	0+000	4+740	4,740

3.1. Current traffic analysis

Traffic evolution coefficients were used for the estimation of the expected traffic until 2030, updated by CESTRIN, considering as basic data the year 2010 (table 3).

Table 3. **Traffic equalization coefficients, period 2010...2030, county roads**

Vehicle type	Year				
	2010	2015	2020	2025	2030
Bicycles and motorcycles	1	0,87	0,75	0,65	0,57
Cars	1	1,23	1,45	1,72	2,03
Minibuses	1	1,21	1,38	1,59	1,82

Vehicle type	**Year**				
	2010	**2015**	**2020**	**2025**	**2030**
Pick ups	1	1,22	1,44	1,74	2,08
2-axle trucks and derivatives	1	1,20	1,34	1,51	1,69
3 or 4 axle trucks and derivatives	1	1,19	1,36	1,54	1,74
Articulated vehicles (Type TIR), vehicles with more than four axles, tugs with trailer	1	1,14	1,26	1,40	1,56
Buses	1	1,19	1,39	1,61	1,88
Tractors with / without trailers and special vehicles	1	1,14	1,26	1,39	1,53
Trucks with trailer (road train)	1	1,10	1,20	1,31	1,43
Animal drawn vehicles	1	0,62	0,39	0,24	0,15
Total	1	1,19	1,36	1,58	1,83

The reviewed traffic on DJ 665D is presented by table 4.

Table 4. **Reviewed traffic on DJ 665D, ADF 2010, 2015**

Vehicle type	Traffic reviewed **2010** **CESTRIN**	Traffic reviewed **2015** **OWN**
Bicycles and motorcycles	51	60
Cars	770	1003
Minibuses	43	52
Pick ups	79	96
2-axle trucks and derivatives	42	50
3 or 4 axle trucks and derivatives	38	33
Articulated vehicles (Type TIR), vehicles with more than four axles, tugs with trailer	20	23
Buses	10	16
Tractors with / without trailers and special vehicles	11	19
Trucks with trailer (road train)	27	17
Animal drawn vehicles	9	15
Total	1100	1384

The infrastructure development and improvement (roads, access ways and related services) in the area aims the following:

- the improvement of the traffic conditions and traffic safety;
- the inclusion of the road in the national touring circuit.

3.2. Future traffic design

According to the UE methodology for traffic studies and estimations, the economic growth alternative is the most likely to be considered. For the design of future traffic, we must take into consideration the evolution of the national economy in the european context. As for Romania, the evolution of the Gross Domestic Product

presented important fluctuations during 2000-2015 (fig. 2).

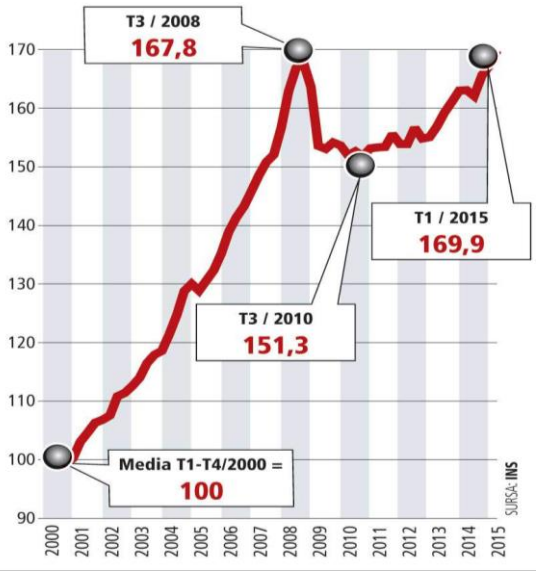

Fig. 2. România – quarterly GDP period 2000-2015
(quarter average for 2000=100)
(http://storage0.dms.mpinteractiv.ro/media/1/1481/21333/14420301/3/3-pib.jpg)

For Romania, considering the GDP evolution between 2000-2015 and the estimation of the National Prognosis Comission and international organizations, we can estimate for 2016-2025 an evolution of yearly average rate of GDP between 3,5% and 5,5%. The vehicle park (table 5) evolved fast between 1989-2015. The most important increase was for autovehicles – it increased 4,33 times. The situation does not include the road autovehicles for special situations, road tractors, trailers and semitrailers or campers, which for 2015 is 418174 vehicles, the total vehicle park being 6600325 vehicles.

Table 5. **The evolution of the vehicle park during 1989 - 2015**

Traffic registered vehicles	**Number of vehicles**					
	1989	**1995**	**2000**	**2005**	**2010**	**2015**
Mopeds and motorcycles	306157	327724	239208	197401	84120	111860
Cars	1189938	2197447	2777594	3363779	4307290	5153182
Buses and minibuses	28272	42047	40716	39273	39140	46188
Freight cars	258701	343064	427152	493821	667458	870921
Total vehicle*	1513068	2601282	3484670	4094274	5098008	6182151
Park evolution compared to 1989	1	1,72	2,3	2,71	3,37	4,09

Source: Department of auto-vehicles licenses and registration

The CNADNR posts the reviewed traffic flux values after processing the census data, both for the national road network and for the county networks but also, less important, for local significant roads. Meanwhile CNADNR gives also the estimation scenarios for traffic increase on the national road networks, correlating with the national macroeconomic indicators (GDP). Below we will use the estimation of the yearly increase rates for road traffic for 2010-2030, given by CESTRIN-CNADNR for county road networks in Romania.

Thus, the detailing of the demand estimation for the parts of the studied road, respectively the yearly average daily traffic (ADF) during 2010-2030, on vehicle groups, expressed in physical vehicles, standard auto-vehicles (conventional) and „115 kN standard axle" vehicles is given by tables 6, 7 and 8 and by figures 3, 4 and 5.

Table 6. **ADF traffic on DJ 665D in physical vehicles / 24 hours**

Vehicle type	**Year**				
	2010	**2015**	**2020**	**2025**	**2030**
Bicycles and motorcycles	51	44	38	33	29
Cars	770	947	1117	1324	1563
Minibuses	43	52	59	68	78
Pick ups	79	96	114	137	164
2-axle trucks and derivatives	42	50	56	63	71
3 or 4 axle trucks and derivatives	38	45	52	59	66
Articulated vehicles (Type TIR), vehicles with more than four axles, tugs with trailer	20	23	25	28	31
Buses	10	12	14	16	19
Tractors with / without trailers and special vehicles	11	13	14	15	17
Trucks with trailer (road train)	27	30	32	35	39
Animal drawn vehicles	9	6	4	2,0	1
Total	**1100**	**1309**	**1496**	**1738**	**2013**

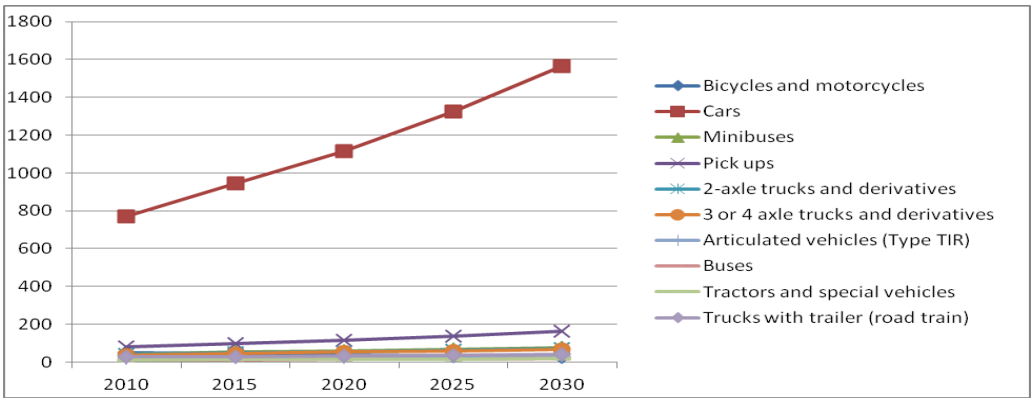

Fig. 3. ADF traffic on DJ 665D in physical vehicles/24 hours

Table 7. **ADF traffic on DJ 665D in standard auto-vehicles**

Vehicle type	**Year**				
	2010	**2015**	**2020**	**2025**	**2030**
Bicycles and motorcycles	26	22	19	17	15
Cars	770	947	1117	1324	1563
Minibuses	43	52	59	68	78
Pick ups	79	96	114	137	164
2-axle trucks and derivatives	210	250	280	315	355
3 or 4 axle trucks and derivatives	190	225	260	295	330
Articulated vehicles (Type TIR), vehicles with more than four axles, tugs with trailer	100	115	125	140	155
Buses	29	35	41	46	55
Tractors with / without trailers and special vehicles	55	65	70	75	85
Trucks with trailer (road train)	135	150	160	175	195
Animal drawn vehicles	27	18	12	6	3
Total	**1664**	**1745**	**2246**	**2598**	**2928**

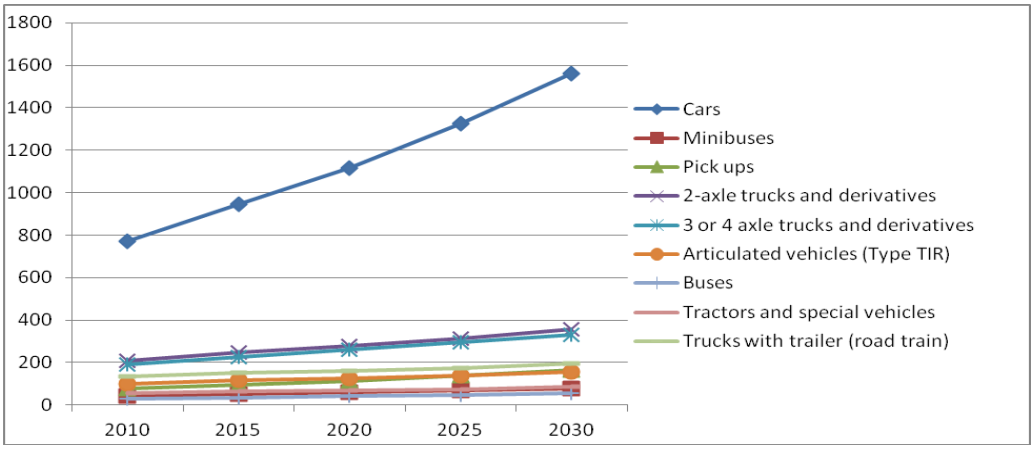

Fig. 4. ADF traffic on DJ 665D in standard auto-vehicles

Table 8. **ADF traffic on DJ 665D in „115 kN standard axle" vehicles**

Vehicle type	**2010**	**2015**	**2020**	**2025**	**2030**
2-axle trucks and derivatives	13	15	17	19	21
3 or 4 axle trucks and derivatives	30	36	42	47	53
Articulated vehicles (Type TIR), vehicles with more than four axles, tugs with trailer	18	21	23	25	28
Buses	6	7	8	10	11
Tractors with / without trailers and special vehicles	2	3	3	3	3
Trucks with trailer (road train)	19	21	22	25	27
Total	**88**	**103**	**115**	**129**	**143**

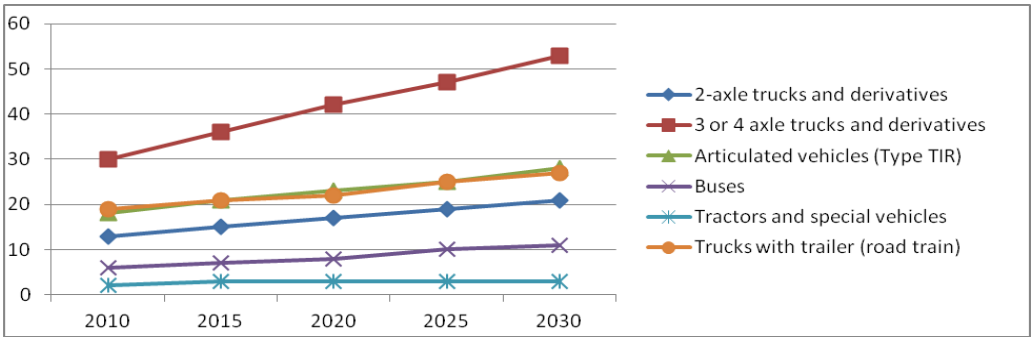

Fig. 5. ADF traffic on DJ 665D in „115 kN standard axle" vehicles

The technical classification of the county road DJ 665D, according to the „Technical norms regarding the settling of technical class of public roads" no. 46/1998 is presented by table 9.

Table 9. **The technical classification of the county road DJ 665D**

Parts limits, km	**ADF/24 hours, in 2030**		**Technical class**
	Physical vehicles	**Standard auto-vehicles**	
0+000...4+740	2013	2928	IV

From the data of table 9 it results that the county road DJ 665D is technical class IV, average traffic, having a yearly average daily intensity higher than 750 physical vehicles / 24 hours and 1000 standard auto – vehicles / 24 hours.

For hill lands, the equalizing coefficients of physical vehicles into standard auto-vehicles are presented in table 10.

Average equalizing coefficients, classified into vehicle groups presented in table 11, were used for equalizing the physical vehicles traffic into 115 kN standard axles for reinforcement sizing of light and semi-rigid road networks.

The calculus traffic expressed in physical vehicles, standard vehicles and 115 kN axles is presented by table 12 and figure 6. The determination of calculus traffic for road design, expressed in standard vehicles and 115 kN axles is done according to SR 7348-2002 and to the norms PD 189-2000 and AND 584-2002.

Table 10. **The equalizing coefficients of physical vehicles into standard auto-vehicles, for hill lands, at two lane roads**

Vehicle type	**Coefficient of equivalence standard vehicles**
Bicycles and motorcycles	0,5
Cars, pick ups, minibuses	1,0
2-axle trucks and derivatives	5,0
3 or 4 axle trucks and derivatives	5,0
Articulated vehicles	5,0
Buses	2,9
Tractors and special vehicles	5,0

Vehicle type	Coefficient of equivalence standard vehicles
Trucks with trailer	5,0
Animal drawn vehicles	3,0

Table 11. **Average equalizing coefficients of physical vehicles into 115 kN standard axles**

Type of road system	Vehicle type					
	2-axle trucks and derivatives	3 or 4 axle trucks and derivatives	Articulated vehicles	Buses	Tractors and special vehicles	Trucks with trailer
Flexible and semi-rigid reinforcement road systems	0,3	0,8	0,9	0,6	0,2	0,7

Table 12. **Calculus traffic for DJ 665D, sector km 0+000 - 4+740**

Year	ADF		
	Total vehicles	Standard vehicles, cars	Axles 115kN
			Flexible and semi-rigid reinforcement road systems
2010	1100	1664	88
2015	1309	1745	103
2020	1496	2246	115
2025	1738	2598	129
2030	2013	2928	143

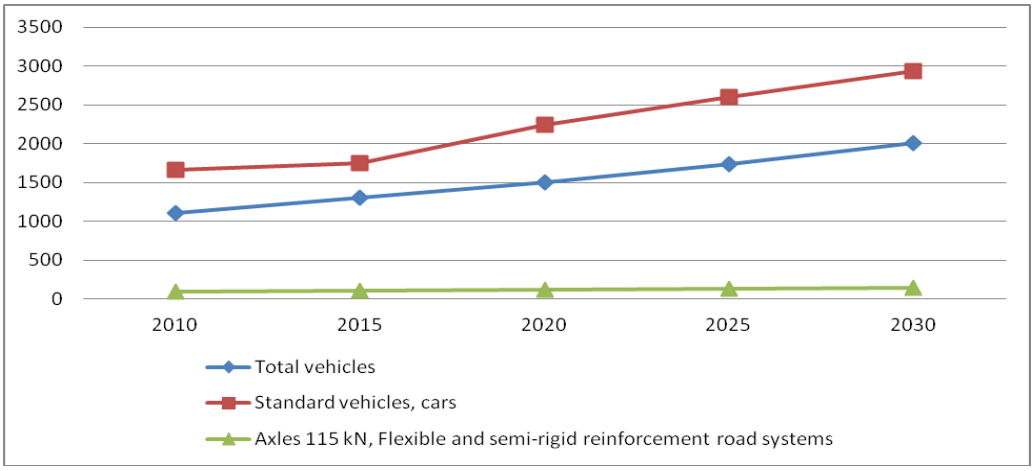

Fig. 6. Calculus traffic for DJ 665D, sector km 0+000 - 4+740

4. CONCLUSIONS

The traffic study estimated the current and possible traffic for 2010-2030 on the county road DJ 665D part km 0+000 - 4+740.

The traffic was expressed in yearly average daily traffic, on vehicle groups –

all vehicles, standard auto-vehicles (conventional vehicles) and 115 kN standard axles needed for sizing the road structures.

The investment opportunity is given by socio-economic reasons as:

- by modernizing the county road DJ 665D the vehicle traffic speed increases so the time spent in traffic is lower;
- the fuel consumption and the maintenance and repairing costs of the auto-vehicle park is lower;
- the area atractiveness increases;
- the pollution degree is reduced by lowering the emission of various noxes and dust volume;
- functionally, the traffic safety and confort increases.

REFERENCES:

[1]. **Bănică, M.,** *About the environmental influence of rehabilitation works for the county road DJ 665 Curtişoara – Crasna – Novaci – Baia de Fier - Racoviţa, km 0+000–54+400* in „Roads and environment – Essays and reports", Dalami Publishing, Caransebeş, 2004
[2]. *Ind. PD 189 - 2000. Norms for determining the traffic capacity on public roads*
[3]. *Ind. AND 584 - 2002. Norms for determining the traffic calculus for road design considering the bearing and traffic capacities*
[4]. *Ind CNADNR 584. Norm review* AND 584 - 2002. 2nd final draft. *BOMACO SRL,* 2007
[5]. *Ind. AND 578 - 2002. Norms for determining the land characteristics for road designing and for establishing their traffic capacity*
[6]. *SR 7348 - 2002. Vehicle equalizing for establishing traffic capacity*
[7]. *Ord. MTCT 1249/2004. Instructions for traffic registration on public roads in 2005*
[8]. 2010 traffic census. Synthesis, *CESTRIN 2010*
[9]. Central European Bank – Annual report, 2012
[10]. ***, National Strategy for Sustainable Development in Romania, Levels 2013-2020-2030
[11]. ***, http://www.its.dot.gov/index.htm
[12]. ***, http://www.itsa.org/
[13]. ***, http://www.mie.ro/index.php?p=159
[14]. ***, http://www.mmediu.ro/dezvoltare_durabila/sndd.htm
[15]. ***, http://www.mt.ro/