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PERSPECTIVE OF CROSS-CUTTING CRITERIA AS A MAJOR INSTRUMENT TO DETERMINATION OF CRITICAL INFRASTRUCTURE IN THE CZECH REPUBLIC

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ABSTRACT

This paper is concerned by issue of cross-cutting criteria by view of European Union and relevant Member States and regional level. Therefore it defines general solution for designation process of critical infrastructure elements. The paper consequently presents comparison of cross-cutting criteria in the Czech Republic and European Union. Thoughtful look of cross-cutting criteria and regional critical infrastructure is following collated by present knowledge in realm of critical infrastructure in the Czech Republic.

KEY WORDS

Critical infrastructure; cross-cutting criteria; regional critical infrastructure

INTRODUCTION

Critical infrastructure protection without rules of selection process from assembly of elements is impossible. Therefore, there were set up solutions on European level and each Member State of European Union held out solutions on its national level. European critical infrastructure is the highest level for realm of critical infrastructure protection across all Member States of European Union. The Czech Republic also had to choose elements on European critical infrastructure on its territory. Every Member State has approached to determining process of critical infrastructure elements in different ways. The Czech Republic has been working on determining process of regional critical infrastructure elements.

GENERAL SOLUTION FOR DESIGNATION PROCESS OF CRITICAL INFRASTRUCTURE ELEMENTS

The fundamental document for critical infrastructure protection is Communication from the Commission on a European Programme for Critical Infrastructure Protection (1) which is based on acceptance of Council directive 2008/114/EC on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection (2).

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For the purpose of this Directive European critical infrastructure means critical infrastructure located in Member States with disruption or destruction and would have a significant impact on at least two Member States. The significance of the impact shall be assessed in terms of cross-cutting criteria. This includes effects resulting from across-sector dependencies on other types of infrastructure. This Directive established cross-cutting and sectoral criteria for identification of Europe Critical Infrastructures. These cross-cutting criteria comprised the following:

- Casualties criterion - term of the potential number of fatalities or injures.
- Economic effects criterion - terms of the significance of economic loss and/or degradation of products for services; including potential environmental effects.
- Public effects criterion - terms of the impact on public confidence, physical suffering and disruption of daily life; including loss of essential services.

The cross-cutting criteria thresholds should be based on the severity of the impact of the disruption or destruction of a particular infrastructure. The precise thresholds applicable to the cross-cutting criteria should be determined on a case-by-case basis by the Member State concerned by a particular critical infrastructure. The Directive determined two sectors of European critical infrastructures: energy with three subsectors (electricity, oil, gas) and transport with five subsectors (road tr., rail tr., air tr., inland waterways tr., ocean and short-sea shipping and ports) (2).

Critical infrastructure protection in Czech Republic coming out from the Directive 2 and there are created two strategic documents – the first is the Complex strategy for solving realm of critical infrastructure in Czech Republic 3 and the other is the National program for critical infrastructure protection (4). Implementation of the Directive (2) and two national strategic documents (3) (4) was realized by actualization of the law for crisis management (5). National program (4) determined two basic criteria for selection/non-selection of critical infrastructure elements – replaceable and irreplaceable. Irreplaceable is an element of infrastructure whose function cannot be re-established in short time. Next condition for purpose of critical infrastructure elements of national level is fulfilment of sectoral and cross-cutting criteria. There are nine sectors of critical infrastructure in the Czech Republic (energy, water management, food industry and agriculture, health services, communication and information systems, financial market and currency, emergency services, public administration). Cross-cutting criteria for national level of critical infrastructure comprised the following:

- Public effects criterion – borderline value of large scale reduces for provides of essential services to 125 thousand people.
- Economic effects criterion – borderline value of economic loss for gross domestic product more than 0,5 % or higher.
- Casualties criterion – borderline value of the potential fatalities is 250 and borderline value of the potential injures is 2 500 with condition of consequent hospitalization exceed to 24 hours.

All borderlines values for cross-cutting criteria are determined by relevant Government Regulation (6). There is determined solution only for European and national level critical infrastructure in the Czech Republic. The term “regional critical infrastructure” was established by the most important strategic document for realm of civil protection - The Conception of population protection to 2013 with long-range outlook to 2020 (7).

COMPARISON OF CROSS-CUTTING CRITERIA IN CZECH REPUBLIC AND EUROPE

Every Member State of Europe Union fulfilled a duty of implementation Directive (2) to its legislature. Implementation was effected by the law of crisis management (5) and by the

relevant government directive (6) in the Czech Republic. Establishment of cross-cutting criteria were performed by transformation of values to conditions in the Czech Republic – identical cross-cutting criteria on different value only (8).

Spain implemented the Directive by the law of measure for critical infrastructure protection (8) and its constituent are elaborating suggestion of cross-cutting criteria without representation the specific limit – these values are confidential. Implementation of the Directive was performed by the law of crisis management (9) in Poland in 2009. Poland and Spain determined limits of cross-cutting criteria in non-specify values. Hungary implemented the Directive by the law of crisis systems and equipment, and its identification and marking and protecting (10). There is the similar government directive to cross-cutting criteria in Hungary (11) as the relevant directive in the Czech Republic. Comparison of cross-cutting criteria in mentioned countries is presented in (12) Table *1* (12).

COMPARISON OF CROSS-CUTTING CRITERIA IN RELEVANT COUNTRIES (12)

Table 1

Comparison cross-cutting criteria						
State		**Czech Republic**	**Slovakia**	**Hungary**	**Poland**	**Spain**
Population (2013)		10 516 125	5 410 836	9 908 798	38 533 299	46 704 308
Criteria	**Health and life**	X 1	X	X 1	X	X
	Impact to society	X 1	X	X 1	X	X
	Property	X 1	X	X 1	X	X
	Environment	-	X	X 1	X	X
	Dependency	-	-	-	-	-
	Psychological impact	-	-	-	-	-
	Political impact	-	-	X	-	X
	Time impact	-	-	-	-	-
	Replaceable	-	X	-	-	-

X Criterion **is** component of assessment - **without** specify limit value
X 1 Criterion **is** component of assessment - **with** specify limit value
- Criterion **is not** component of assessment.

Every country has different definition of cross-cutting criteria for national and European critical infrastructure elements. There was not use criterion for assessment consequences to environment and political impact in the Czech Republic but these criteria are used in Hungary. Limit values of cross-cutting criteria are specified only in the Czech Republic and Hungary. The criterion of the Czech Republic is 250 fatalities people or 2500 injures people with following hospitalization up to 24 hours. The criterion of Hungary is conversely 20 fatalities people or 75 injures up to 24 hour (the second regulation is 40 fatalities or 150 injures up to 72 hours). There is a prominent difference after the comparison of cross-cutting criteria in both countries if cross-cutting criteria are conversed to value of population of these countries.
By virtue of comparison in (12) Table *1*, the first problem is unavailing criterion of dependency, psychological impact, political impact, time impact and replaceable. Consequently, the second problem is non-implementation of criteria which were adduced in the Commission Directive (2).

CROSS-CUTTING CRITERIA AND REGIONAL CRITICAL INFRASTRUCTURE

This chapter describes possible variant of transformation criteria from national level in the Czech Republic to demands regional critical infrastructure level. Reciprocal transformation was realized to cross-cutting criteria from European level to national critical infrastructure level.

For calculation was used data from Czech Statistical Office (14). Range of data monitoring was since 2010 (when were cross-cutting criteria created) to 2012 (last available data).

Transformation of public effects criterion

Transformation is coming out from value 125 000 affected people ($C1_{CR}$) apply by formula [1] to total number of citizens in Czech Republic (TC_{CRi}) in relevant year. **Final rate ($D1_i$)** is used by formula [2] for conversion to borderline number ($C1_{ij}$) of affected people in relevant region. Results are presented in (13) Table *2* (13).

$$\boldsymbol{D1_i = \frac{C1_{CR}}{TC_{CRi}} \quad [\%]} \qquad [1]$$

$$\boldsymbol{C1_{ij} = D1_i \times TC_{Rij} \quad [people]} \qquad [2]$$

Where $D1_i$ = dynamical value of public effects criterion for i-year; $C1_{CR}$ = original value of public effects criterion for national level; TC_{CRi} = total number of citizens in Czech Republic for i-year; $C1_{ij}$ = borderline number of affected people for i-year and for j-region; TC_{Rij} = total number of citizens in relevant region for i-year and for j-region.

BORDERLINE NUMBERS OF AFFECTED CITIZENS IN RELEVANT REGIONS (13)

Table 2

Transformation of public effects criterion				
Year	**2010**	**2011**	**2012**	**Unit**
$\boldsymbol{TC_{CRi}}$	10,53 mil	10,50 mil	10,51 mil	citizens
$\boldsymbol{D1_i}$	**1,187%**	**1,190%**	**1,189%**	**[%]**
Capital city Prague	14 920	14 774	14 820	**$C1_{ij}$ (number of affected people in relevant region)**
Central Bohemia Region	15 012	15 222	15 355	
South Bohemia Region	7 580	7 569	7 567	
Plzeň Region	6 789	6 803	6 807	
Karlovy Vary Region	3 649	3 607	3 586	
Ústí nad Labem Region	9 922	9 852	9 827	
Liberec Region	5 221	5 219	5 213	
Hradec Králové Region	6 584	6 590	6 573	
Pardubice Region	6 138	6 145	6 139	
Vysočina Region (Highlands)	6 107	6 091	6 076	
South Moravian Region	13 703	13 877	13 891	
Olomouc Region	7 615	7 599	7 579	
Zlín Region	7 006	7 009	6 986	
Moravian-Silesian Region	14 754	14 643	14 580	

Transformation of economic effects criterion

Transformation is coming out from value of economic loss for gross domestic product (GDP) 0,5% which is used for national level ($C2_{CR}$). Therefore, there is applied only number of affected people in following calculation because this value is the most dominant from national criteria (fifty times higher than value of potential injures). Utilization of regional public effects criterion ($C1_{ij}$) for calculation regional economic effects criterion is self-evident. Economical loss per one citizen was determined of relevant region ($GDP1_{ij}$) by virtue of available data (14) in formula [3] with using values for regional GDP (GDP_{Rij}) and number of citizens in relevant region (TC_{Rij}). Total economic loss for regional gross domestic product (ΔGDP_{Rij}) is determined by formula [4]. Relationship between economical loss for regional

gross domestic product and classic regional GDP is presented by formula [5]. Final values are described in (13) Table *3* (13).

$$GDP_{1ij} = \frac{GDP_{Rij}}{TC_{Rij}} \quad [€] \qquad [3]$$

$$\Delta GDP_{Rij} = GDP_{1ij} \times C1_{ij} \quad [€] \qquad [4]$$

$$C2_{ij} = \frac{\Delta GDP_{Rij}}{GDP_{Rij}} \quad [€] \qquad [5]$$

Where GDP_{1ij} = gross domestic product per one citizen for i-year and j-region; GDP_{Rij} = regional gross domestic product for i-year and for j-region; TC_{Rij} = total number of citizens in relevant region for i-year and for j-region; ΔGDP_{Rij} = total economic loss for regional gross domestic product for i-year and for j-region; $C1_{ij}$ = borderline number of affected people for i-year and for j-region; $C2_{ij}$ = borderline value of economic loss for regional gross domestic product.

ECONOMICAL LOSS FOR REGIONAL DOMESTIC PRODUCTS CALCULATED BY DYNAMICAL VALUES OF CRITERION $D1_i$ AND ALSO PRESENTATION VALUES OF CRITERION $C2_{ij}$ (13) Table 3

Economical loss for regional domestic products of relevant regions [mil. €]									
Year	**2010**			**2011**			**2012**		
Czech Republic Regions	$D1_i$ = 1,187%			$D1_i$ = 1,190%			$D1_i$ = 1,189%		
	GDP_{Rij}	ΔGDP_{Rij}	$C2_{ij}$	GDP_{Rij}	ΔGDP_{Rij}	$C2_{ij}$	GDP_{Rij}	ΔGDP_{Rij}	$C2_{ij}$
Capital city Prague	34 611	420.5	**1.215%**	35 579	424.1	**1.192%**	34 694	413.2	**1.191%**
Central Bohemia Reg.	14 376	175.5	**1.220%**	15 027	179.2	**1.192%**	15 309	182.8	**1.194%**
South Bohemia Reg.	6 943	84.1	**1.211%**	7 185	84.1	**1.170%**	7 243	87.8	**1.121%**
Plzeň Region	6 263	76.7	**1.224%**	6 808	80.4	**1.181%**	6 815	80.4	**1.179%**
Karlovy Vary Region	2 629	32.9	**1.251%**	2 877	32.9	**1.144%**	2 859	32.9	**1.151%**
Ústí nad Labem Reg.	8 428	109.7	**1.301%**	8 866	106.0	**1.196%**	8 928	106.0	**1.187%**
Liberec Region	3 846	51.2	**1.331%**	4 471	54.8	**1.226%**	4 548	54.8	**1.220%**
Hradec Králové Reg.	5 905	73.1	**1.237%**	6 388	76.8	**1.202%**	6 344	76.7	**1.209%**
Pardubice Region	5 404	62.2	**1.150%**	5 601	65.8	**1.175%**	5 473	65.8	**1.202%**
Vysočina Region (Highlands)	5 100	65.7	**1.288%**	5 623	65.8	**1.170%**	5 755	69.4	**1.206%**
South Moravia Reg.	13 883	168.2	**1.211%**	14 482	171.8	**1.186%**	14 756	175.5	**1.189%**
Olomouc Region	6 113	76.7	**1.254%**	6 537	76.8	**1.175%**	6 633	80.4	**1.212%**
Zlín Region	6 204	76.8	**1.238%**	6 669	80.4	**1.206%**	6 932	84.1	**1.213%**
Moravian-Silesian Reg	12 867	160.8	**1.249%**	14 340	171.8	**1.198%**	14 340	171.8	**1.198%**

(13) Table *3* presents various values of economic loss for regional gross domestic products which are dynamical variable for relevant region and relevant year. All values of economical criterion are higher than borderline value for national level (13).

Transformation of casualties criterion

Transformation is coming out from borderline value 250 potential fatalities people ($C3f_{CR}$) and from borderline value 2500 potential injures people ($C3i_{CR}$) to applying for total number of citizens in Czech Republic (TC_{CRi}) in relevant year by formula (6)&(8). **Final rates (*$D3f_i$* & *$D3i_i$*)** are used by formula [7] & [9]for conversion to borderline of regional criteria for potential fatalities ($C3f_i$) and for potential injures ($C3i_i$). All result values are presented in Table *4* (13).

$$D3f_i = \frac{C3f_{CR}}{TC_{CRi}} \quad [\%] \qquad [6]$$

$$C3f_{ij} = D3f_i \times TC_{Rij} \quad [people] \qquad [7]$$

$$D3i_i = \frac{C3i_{CR}}{TC_{CRi}} \quad [\%] \qquad [8]$$

$$C3i_{ij} = D3i_i \times TC_{Rij} \quad [people] \qquad [9]$$

Where $D3f_i$ = dynamical value of potential fatalities for i-year; $D3i_i$ = dynamical value of potential injures for i-year; $C3f_{CR}$ = original value of potential fatalities criterion for national level; $C3i_{CR}$ = original value of potential injures criterion for national level; TC_{CRi} = total number of citizens in Czech Republic for i-year; $C3f_i$ = borderline number of fatalities people for i-year and for j-region; $C3i_i$ = borderline number of injures people for i-year and for j-region; TC_{Rij} = total number of citizens in relevant region for i-year and for j-region.

CALCULATION OF BORDERLINE VALUE OF POTENTIAL FATALITIES $C3f_{ij}$ AND BORDERLINE VALUE OF POTENTIAL INJURES $C3i_{ij}$ (13) Table 4

Transformation of casualties criterion				
Year	**2010**	**2011**	**2012**	**Unit**
TC_{CRi}	10,53 mil	10,50 mil	10,51 mil	citizens
$D3f_i$	**0,00237%**	**0,00238%**	**0,00238%**	**[%]**
$D3i_i$	**0,0237%**	**0,0238%**	**0,0238%**	
Capital city Prague	30 / 297	30 / 295	30 / 295	$C3f_{ij}$ / $C3i_{ij}$
Central Bohemia Region	30 / 297	30 / 304	31 / 304	
South Bohemia Region	15 / 152	15 / 151	15 / 151	
Plzeň Region	14 / 136	14 / 136	14 / 136	
Karlovy Vary Region	7 / 73	7 / 72	7 / 72	
Ústí nad Labem Region	20 / 199	20 / 197	20 / 197	
Liberec Region	10 / 104	10 / 104	10 / 104	
Hradec Králové Region	13 / 132	13 / 132	13 / 132	
Pardubice Region	12 / 123	12 / 123	12 / 123	
Vysočina Region (Highlands)	12 / 123	12 / 122	12 / 122	
South Moravia Region	27 / 274	28 / 278	28 / 278	
Olomouc Region	15 / 153	15 / 152	15 / 152	
Zlín Region	14 / 141	14 / 140	14 / 140	
Moravian-Silesian Region	30 / 297	29 / 293	29 / 293	

CONCLUSION

Determined cross-cutting criteria in Members States are using incorrect, due to non-specify of consequences initiating more inaccuracy to determination process of critical infrastructure elements. Criteria were specified on diverse level and such values non-correspond to real consequences. Casualties criterion belongs to traditional risk analysis criterion. Difference

between risk criteria and criteria for determination of critical value is presented in relevant paper (15).

There is a clear example of selection criteria on non-appropriate level – realization the analysis of Black-out and its consequences since 1960 points out to unattainable values of cross-cutting criteria. Number of affected people is always on million`s level but conversely number of injures is on level only for individual citizens. Traditional values of cross-cutting criteria non-describe altitude of consequences (15).

Transformation of all cross-cutting criteria was mentioned and was presented as practicable in the Czech Republic. Used cross-cutting criteria for regional critical infrastructure are set up closely to practise extraordinary events (13).

New strategic document for realm of civil protection in the Czech Republic – The Conception of population protection to 2020 with long-range outlook to 2030 – recommends revision of sectors of critical infrastructure and revision of Government Regulation for cross-cutting and sectoral criteria (16).

The analysis of cross-cutting criteria was worked out with using data from project of specific research VSB-Technical university of Ostrava titled SP2013/152.

Transformation of national cross-cutting criteria of the Czech Republic to demands regional critical infrastructure was worked out with using data of specific research VSB-Technical university of Ostrava titled SP2014/108.

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