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# USER'S VIEW OF THE QUALITY OF CROATIAN TOPOGRAPHIC MAP AT THE SCALE 1:25 000

## KORISNIČKI POGLED NA KVALITETU HRVATSKE TOPOGRAFSKE KARTE MJERILA 1:25 000

***Branko Pucekovi*ć*, Miljenko Lapaine***

**ABSTRACT**

*The subject of this research was the quality of the Croatian Topographic Map at the scale of 1:25 000 (TM25). The needed information was collected by using a questionaire. Emphasis was put on aesthetics and logical consistency. The total of 42% out of 165 users participated in the questionnaire. According to the survey, quality can be improved by these quality elements: content completeness, geometrical accuracy, geographic fidelity, contemporaneity and the aesthetic appearance. Even though aesthetics is not a priority for some, users give concrete suggestions with the objective to improve the aesthetics of TM25. Content completeness is the most important element to respondents in their work, while the aesthetics is the least important. One of the results of the research is that the Croatian TM25 is suitable for use by 99% of users.*

***Keywords: topographic map, map quality, Croatia***

**SAŽETAK**

*Predmet istraživanja je kvaliteta hrvatske topografske karte mjerila 1:25 000 (TK25). Potrebne informacije prikupljene su provođenjem ankete. Naglasak je stavljen na estetiku i logičku konzistentnost. U anketi je sudjelovalo ukupno 42% od 165 kontaktiranih korisnika. Dobiveni rezultati pokazuju da se kvaliteta karte može poboljšati sljedećim elementima kvalitete: potpunost sadržaja, geometrijska točnost, geografska vjernost, suvremenost i estetski izgled. Premda estetika nekima nije prioritet, korisnici su dali konkretne preporuke s ciljem poboljšanja estetike TK25. Element koji je ispitanicima nabitniji u njihovu radu je potpunost sadržaja, a estetika im je najmanje važna. Jedan od rezultata istraživanja je da hrvatska TK25 zadovoljava potrebe 99% korisnika.*

***Ključne riječi: topografska karta, kvaliteta karte, Hrvatska***

## 1 INTRODUCTION

Production of the new topographic map of the Republic of Croatia at the scale of 1:25 000 (TM25) started in 1996 and ended in 2009, when all 594 sheets were put in official use. TM25 was produced in the coordinate system of the Transverse Mercator Projection – abbreviated HTRS96/TM, with central meridian 16°30' and the linear scale factor along the central meridian of 0.9999, as the coordinate system of the Republic of Croatia for the field of cadastre and state topographic cartography. Ellipsoid GRS80 (Geodetic Reference System 1980) was used for all official computations (Lapaine, 2006).

The entire project of producing TM25 for the Republic of Croatia was performed by the State Geodetic Administration (SGA). The production of TM25 was given to the private geodetic companies. Quality control was done at particular stages during the development of TM25 and tested the accuracy of the general map data according to these categories: margin content, map frame and coordinate grid, map description, trigonometric points relief review, settlements, objects and utility, hydrography, traffic, land cover and land types, toponyms, edge matching, maritime and underwater objects, depth contours, field checking and general alignment of topographic symbols with cartographic key.

The first sheet was put into official use after the establishment of the Croatian Geodetic Institute (CGI) in 2001. One of the main tasks of the CGI was the quality control of SGA's data. This paper aims to estimate the external quality of printed sheets of TM25. To improve external quality, we need to understand what external quality means to data consumers. The purpose of the survey was to find those quality elements that are important to TM25 users. The evaluation of external quality is a field that has been explored very little (Devillers and Jensoulin, 2006). There has been no research of TM25 external quality until now.

## 2 INTERNAL VERSUS EXTERNAL QUALITY

The term quality has many meanings today, depending on whether it is used in philosophy, business or physics. It comes from the Latin word qualitas and the Greek word ποιότητα. A quality is an attribute or a property. In contemporary philosophy the idea of qualities, and especially how to distinguish certain kinds of qualities, one from the other, remains controversial (Cargile, 1995). Quality definition by ISO: The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs. Or simply: a product has good quality when it complies with the requirements specified by the user (FAO 1998, ISO 2005).

Definitions of what quality is vary greatly and there is no consensus in the community on a single definition of quality, although certain definitions, such as those used by ISO, are generally accepted. Therefore, for some people, a quality product is exempt from error, or is a product that is in conformity with the specifications used. For others it is a product that meets consumer expectations. These definitions are grouped into two broad groups: internal quality (products that are exempt from error) and external quality (products that meet user needs). (Devillers and Jensoulin, 2006).

Internal quality is defined by the rules, decrees, instructions and standards. It was determined a priori and by its nature it is both objective and absolute. External quality is subjective and relative because each user has different expectations. It is defined as “fitness for purpose” or as “fitness for use”. This concept "fitness for use" is now widely adopted in the quality literature. It emphasizes the importance of taking a consumer viewpoint of quality because ultimately it is

the consumer who will judge whether or not a product is fit for use (Wang and Strong 1996). The term "fitness for use" was introduced by Juran, Gryna and Bingham (1974).

Wang and Strong (1996) identified four dimensions for external quality, based on a survey conducted among approximately 350 users of non-geospatial data: Intrinsic Data Quality, Contextual Data Quality, Representational Data Quality and Accessibility Data Quality.

The methodology for comparison is available and the expected data quality is presented in Vasseur at al. (2006). With two matrices of quality it is possible to evaluate the external quality of geographical information.

## 3 RESEARCH METHOD

To get an objective answer of user's satisfaction with the map, especially when it comes to map aesthetics, we decided to collect information in a structured way, using questionnaires. The most common methods for obtaining information are: literature searches, interviews with people and target groups of people, personal interviews, telephone surveys, Internet surveys and surveys via e-mail. Each of these methods has its advantages and disadvantages. For our research we chose to conduct surveys via e-mail. The method of the survey by e-mail is more convenient and more economic than interviews because distant people can be surveyed. Furthermore there is no personal contact which can be seen as positive because there is no partiality.

The objective of the survey was to obtain the opinions and attitudes on external quality of TM25 with a focus on aesthetics and logical consistency. The users choose external data quality elements that are considered to be the most significant. In the following paragraphs, we summarize the method and key results of this survey.

This research began with the drafting of the questionnaire (See Appendix). Each question in the survey is related to some hypothesis. To make the survey successful, we tried to make each question theoretically founded. For some questions we previously provided a brief theoretical explanation in order to facilitate the answering for respondents. The users were presented with the attributes that correspond with the external data quality elements: geometric accuracy, geographical fidelity, content completeness, contemporaneity, symbolism of cartographic sign, map overview, map contrast, map readability, colour choice and its harmonization, script types. We added aesthetics, logical consistency, advantages and disadvantages of observing map on the screen and general map suitable for use, which are intuitive and based on experience.

Questions in the questionnaire are divided into the following thematic groups:
I Institutions in general
II Topographic maps use
III Data quality elements and their suitability for use
IV Comments

## 4 CONDUCTING THE SURVEY

The total of 165 questionnaires was sent out and 69 respondents returned the completed questionnaires. The overall reply to the survey is 42%, which we consider as a very good turnout.

In this research were encompassed users of TM25 from different institutions: ministries and public administration bodies, faculties, institutes, county offices, local governments, public institutions, private companies and associations. The aim was to present clear and unambiguous questions, to ensure that all participants have more or less the same level of education, and to include:

- Different professions: geodesy, construction, architecture, geography, geology, forestry;
- Various educational institutions: primary schools, secondary schools, colleges, and
- Different regions.

The questionnaire (see Appendix) asked the respondent to choose the most significant quality elements.

## 5 RESULTS

According to the analysis of the survey results, most respondents, that's 39% were employed in the state administration, 33% in the public institution, while 28% work in private companies. The respondents use topographical maps in their work occasionally 47%, regularly 45% and not use them at all 8%. Both formats are used by 49% of respondents, 47% use only digital format and 4% use only analogue format. In their work most users use the roads 25%, settlements 20%, relief 19%, then hydrography and boundaries 13%, while the vegetation is used by only 10% of users. As an essential element for the aesthetics of maps, 49% of respondents highlighted the beauty and harmony of views, 26% colour compliance, 17% letter on the map and 7% external appearance of the map (Figure 1).

Most of the users, 85% are satisfied with the aesthetic appearance of TM25, the remaining 15% are not satisfied.

The most important element for users is logical consistency of settlements and roads 40%, relief and roads 28%, relief and hydrography 19%, relief and vegetation 11% and settlements and borders 2% (Figure 2).

In their work users essentially need these TM25 qualities: content completeness 36%, geometrical accuracy 25%, geographic fidelity 24%, contemporaneity 13% and the aesthetic appearance 2% (Figure 3).

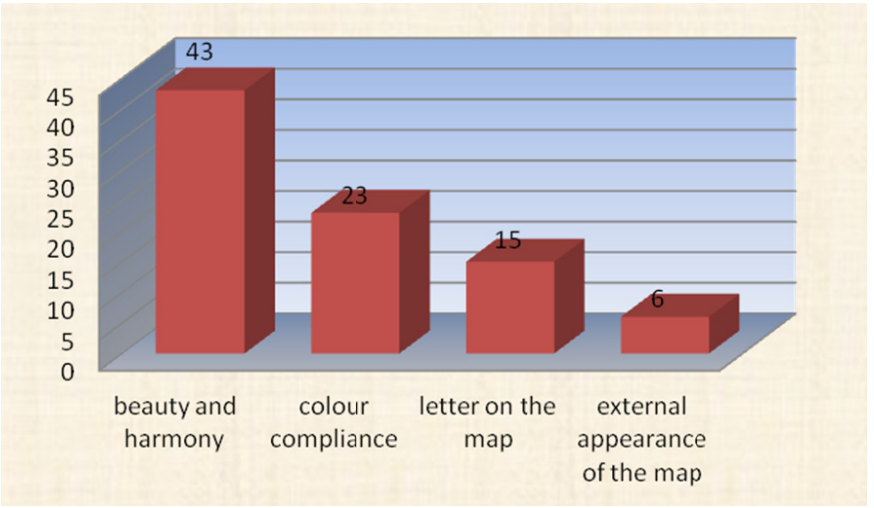


*Figure 1.* Essential elements for the aesthetics of maps.

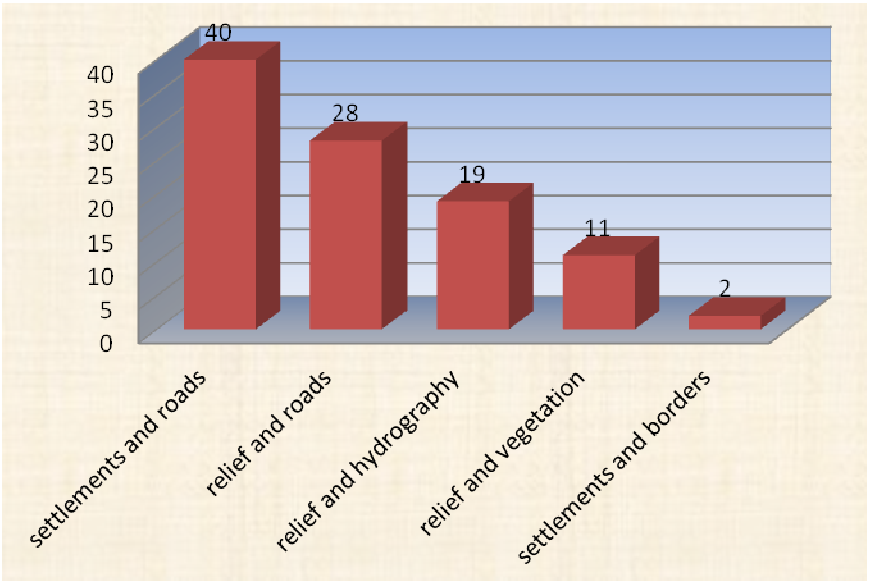


*Figure 2.* Geographical elements for which it is important that they show logical consistency 91% of respondents are satisfied with logical consistency of TM25.

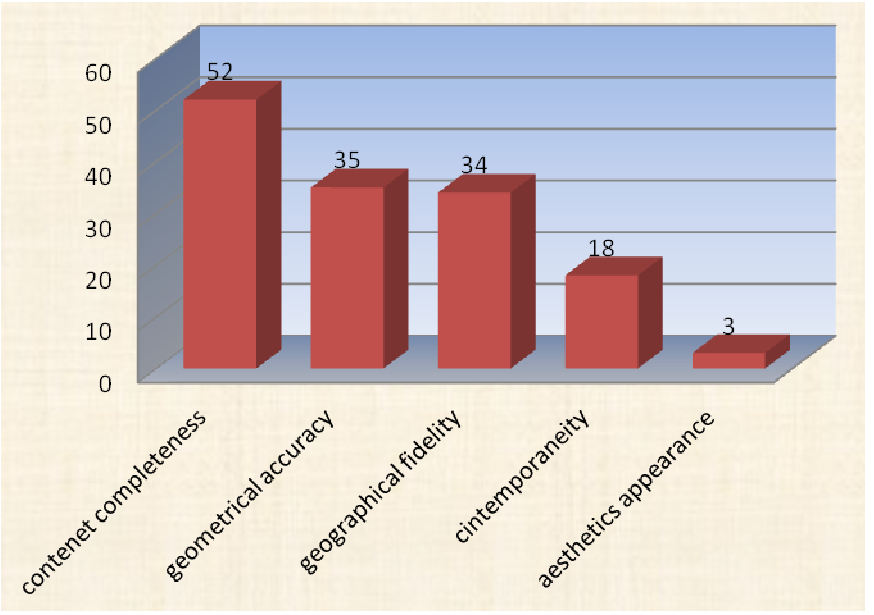


*Figure 3.* TM25 qualities that are absolutely necessary for work.

The respondents are satisfied with symbolism of cartographic sign 87%, with maps overview 78%, with the contrasts 84%, with the readability 83%, with a choice of fonts 84% and with completeness of TM25 87%. 83% of users prefer digital form whereas 17% prefer analogue form. As an advantage in observing the map on the screen of a device, 37% of users take the possibility to increase and decrease the details, 32% easily find the detail and 31% use the layers. As a disadvantage in observing the map on the screen of a device 46% of users consider the limited screen size, 29% of them believe it is due to the resolution limit, 21% consider that there is difficulty in use in the field and 4% consider that the limit is because of the colour. Taking into account all quality elements, 99% of users believe that TM25 is suitable for use.

Suggestions of discontented users for improving aesthetics are: use of shadows for relief, higher quality selection of colours, finer line elements and download aesthetics from Swiss topographic maps.

# 6 CONCLUSION

SGA had entrusted the production of the new Croatian TM25 to private geodetic company from 1996 to 2010. Quality Control TM25 was done by CGI. Topographic maps were controlled according to these categories: margin content, map frame and coordinate grid, map description, trigonometric points relief review, settlements, objects and utility, hydrography, traffic, land cover and land types, toponyms, edge matching, maritime and underwater objects, depth contours, field checking and general alignment of topographic symbols with cartographic key. Until this research there was no documented user feedback about the TM25 quality. The aim of this research was to obtain information about user's satisfaction with the Croatian TM25. Emphasis was put on aesthetics and logical consistency.

Map users received questions by e-mail and responded according to their experience and satisfaction. The research included map users from different professions, education and from various institutions. The questions referred to the company, to the use of maps, to the quality elements and to the comments. 42% of respondents participated in the questionnaire, which we consider very good. That TM25 is suitable for use decided 99% of users.

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## APPENDIX

QUESTIONNAIRE
(Quality of topographic maps)

Please mark or circle your answers.
You can select more then one answer in answering the following questions.

1. The institution you work at is a
State institution
Public institution
Private company
Association

2. Do you regularly use topographic maps (TM) in your work?
Yes, frequently
Periodically
No

3. Which TM format do you use?
Analogue (paper)
Digital
Analogue and digital

4. Which geographic elements on TM do you use the most in your work?
Relief
Hydrography
Vegetation
Settlements
Roads
Borders

5. In your opinion, what are the important elements of map aesthetics?
Font (letters and numbers)
Colour compatibility
Overall beauty and harmony
External map appearance

6. Are you satisfied with TM aesthetics?
Yes
No

7. If your answer to the last question was negative, please suggest how to improve TM aesthetics.

8. Logical consistency concerns logical rules of structure and attribute of geographic map content and describes the consistency of a datum with other data on the map. If a datum on a map is changed and all data derived from it also change, that map can be considered consistent. In your opinion, which geographic elements are the most important to be represented logically consistently?
Relief and hydrography
Relief and vegetation
Relief and roads
Settlements and roads
Something else (what?)_____

9. Are you satisfied with the logical consistency of TM?
Yes
No

10. If your answer to the last question was negative, please suggest how to improve logical consistency of TM.

11. Which TM qualities are indispensable in your work?
Geometrical accuracy
Geographic fidelity
Content completeness
Modernity
Aesthetics

Questions on the artistic map structure, which is composed of map symbols, letters and numbers described in the legend, and marginal map content.

12. Symbolism of map symbols enables one to easily recognize objects and phenomena, and is based on similarity with natural objects or phenomena or the functional characteristic of the represented object. In your opinion, is symbolism good on TM 25?
Yes
No

13. A general map singles out more important content and good differentiation of geographic elements and their categories. A general map enables quick and easy orientation. Do you consider TM 25 a general map?
Yes
No

14. In order to differentiate between parts of map content, one has to take into consideration the relations called contrast. Maps feature contrast lines, colours, width and height, areas, light and dark details. Contrast facilitates map legibility. In your opinion, are contrasts good on TM 25?
Yes
No

15. A map is legible if one is able to see from a certain distance each map symbol as a separate shape differing by size and colour from other shape, and each title and number can be read easily.
In your opinion, is TM 25 legible?
Yes
No

16. Colours on map facilitate content clearness, symbolism, contrast and harmony. In your opinion, are colours on TM 25 compatible?
Yes
No

17. Font of titles and numbers is expected to contribute to map clearness, legibility, contrast and harmony. Are you satisfied with the font?
Yes
No

18. A map is integral if it contains all objects existing in nature at the time of the map's production and which can be represented in the given scale. Do you consider TM 25 an integral map?
Yes
No

19. Which form is better for map use?
Analogue
Digital

20. Which of the following is an advantage of viewing a map on a monitor?
Ease of finding a detail
Zooming in and out
Usage of layers
(Please write your opinion) _____

21. Which of the following is a disadvantage of viewing a map on a monitor?
Difficult field usage (not being able to fold the map or draw on it)
Limited monitor size
Limited representation of detail due to colour
Limited representation of detail due to resolution
(Please write your opinion)_____

22. If you take all elements of quality (geometrical accuracy, geographic fidelity, content completeness, modernity and aesthetics) into consideration, is TM 25 suitable for use?
Yes
No

23. If you want to comment on some aspect of TM 25 quality not addressed in this questionnaire, please do so here.

## *Authors*

***Branko Puceković, dipl. ing. geod.***
State Geodetic Administartion
Gruška 20, 10000 Zagreb
Republic of Croatia
E-mail adress: branko.pucekovic@dgu.hr

***Prof. dr. sc. Miljenko Lapine, dipl. ing. mat.***
Faculty of geodesy, University of Zagreb
Kačićeva 26, 10000 Zagreb
Republic of Croatia
E-mail adress: mlapaine@geof.hr