URBAN ROADS NOISE MODELING BY USING REGRESSION ANALYSIS
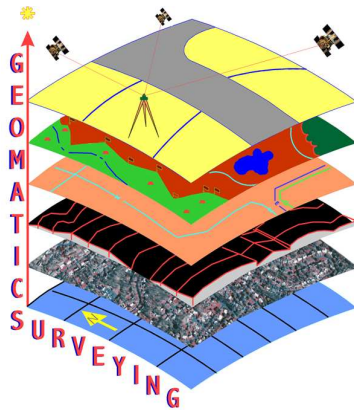
Bülent Bostancı
Abdurrahman Geymen

Erciyes University
Faculty of Engineering
Department of Geomatics
Kayseri/Turkey

FIG XXV Congress, June 16-21, 2014, Kuala Kumpur, Malaysia

THE PURPOSE OF THE STUDY

- In Turkey, the vehicle traffic has increased 10 folds between 1980 and 2012.

- One of the most important issues in the developing and developed countries is the traffic noise (due to the increasing number of the vehicles).

- This study targets to identify the noise levels on the main street by Erciyes University.

- In this study, the relationship among the noise values, road traffic density and the distance to the road have been studied by using the regression analysis.

- Also, GIS aided road traffic noise model have been created.

METHODOLOGY

1. Selection of study area
2. Material and Method
3. Results
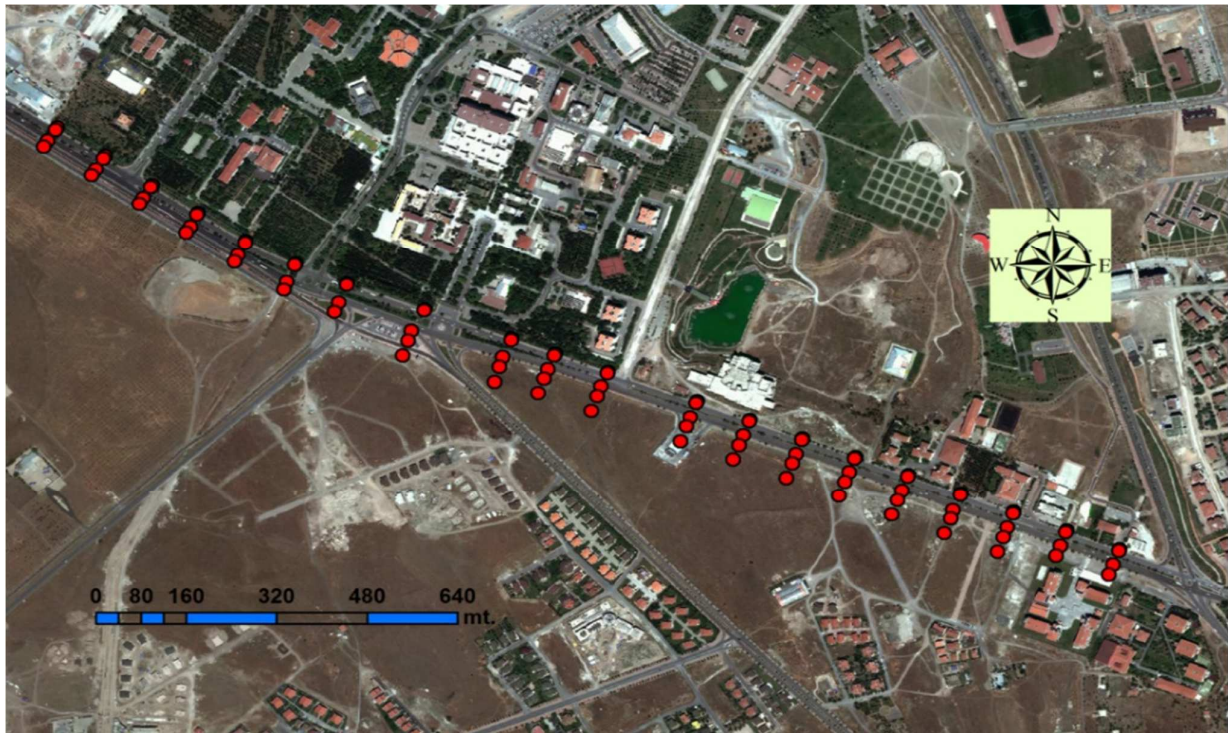4. Conclusions and Recommendations

1. SELECTION OF STUDY AREA

ERCIYES UNIVERSITY

The main street where noise measurement work carried out

2. MATERIAL AND METHOD

Figure 1. Location of 94 noise points identified on the Main Street

2. MATERIAL AND METHOD

- Points defined have been settled on the ground and coordinates have been registered by GPS.
- Noise values have been measured for 3 weeks along the route (approximately for 2 km), in 100 m intervals by using Delta Ohm Type 1 noise measuring equipment.
- It has also been recorded the vehicle numbers and types passed during the measurement.

Delta Ohm Type 1

2. MATERIAL AND METHOD

- The measurements have been carried out in 5 minutes interval in the morning, evening and night hours to record the highest level of noise.

- Names of the points, locations, measurement periods, LEQ, Lmin and Lmax values have been recorded as Excel data file.

3. RESULTS

- The relationship among the noise values, road traffic density and the distance to the road have been studied by using the multiple regression analysis.
- By using SPSS software, data has been assessed by multiple regression analysis, and stepwise regression model has been used as the method of choosing variables.
- Dependant variables are <u>measurements of day</u>, <u>evening</u> and <u>night</u> for 5 minutes,
- Independant variables are the <u>distance</u>, <u>total vehicle number</u>, <u>light vehicle number</u>, <u>heavy vehicle number</u>.

3. RESULTS

Table 1. Cohesiveness degree of the model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimation	Durbin-Watson
1	,757a	,574	,569	2,10595	
2	,783b	,613	,605	2,01687	
3	,794c	,631	**,618**	**1,98218**	**1,480**

- R^2 = 0.618 (cohesiveness degree of the model)
- Rate of the loss in the model is 38,2%.
- Standard error of the assessment has been found as 1,98 dBA.
- As the Durbin Watson coefficient has been found as 1,48, it means that an autocorrelation is not existed.

3. RESULTS

Table 2. Analysis of Variance (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
3	Regression	603,399	3	201,133	51,192	**0,000**
	Residual	353,613	90	3,929		
	Total	957,012	93			

Because F test shows null significance in the Anova table, regression model is significant statistically.

3. RESULTS

Table 3. Coefficients of the variables and fixed value

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
3 (Constant)	**71,849**	2,556		28,111	0,000
neardist	**-0,134**	0,013	-0,703	-10,688	0,000
Heavy vehicles	**0,122**	0,045	0,179	2,714	0,008
Light vehicles	**0,021**	0,010	0,136	2,053	0,043

Regression equation:

$$L_{gag} = 71,849 + (-0,134) \, x \, neardist + 0,122 \, x \, heavyvehicles + 0,021 \, x \, lightvehicles$$

---

3. RESULTS

- Also, the noise map produced in study area.

- ArcGIS 10.x software has been used for analyzing noise and producing noise map.

- Noise values have been assessed with using Kriging interpolation method in "Geostatistical Analyst" module.
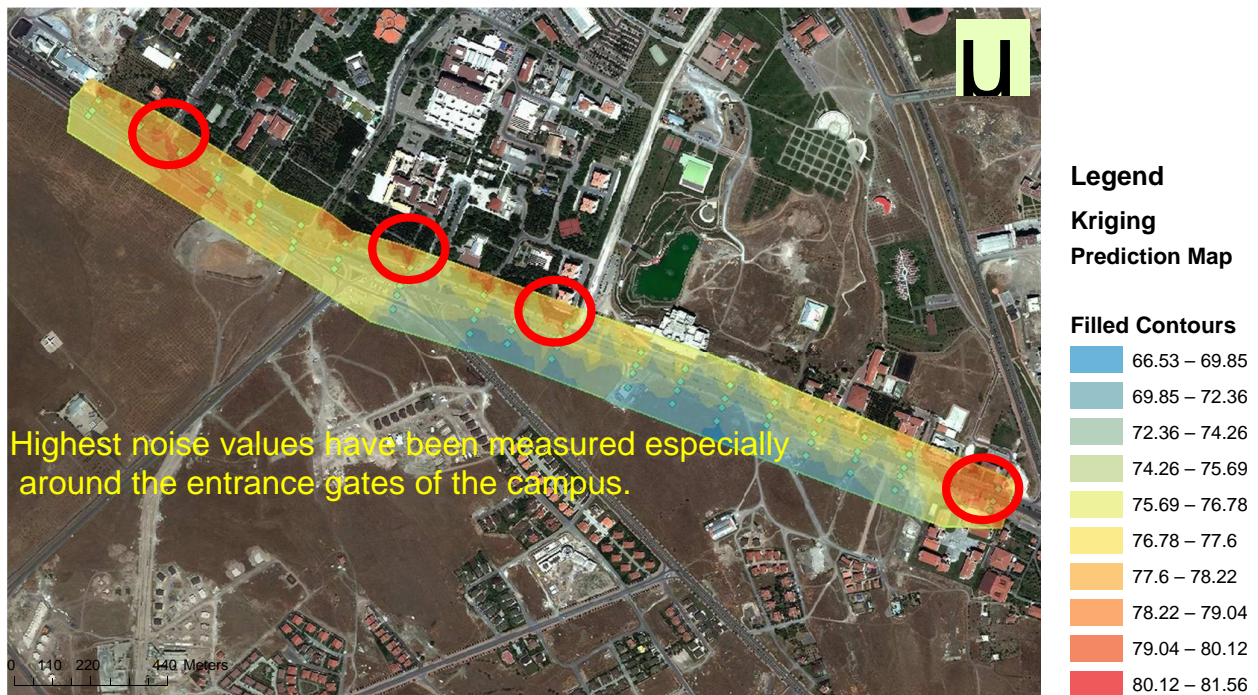
3. RESULTS

Figure 2. Urban road noise map by using Kriging Method

---

4. Conclusions and Recommendations

- The model meets all hypotheses. However, in order to test the noise regression model developed in this study, additional data (obtained from differen study areas) should be used.

- 4 variables that explain the dependant variable were used as input variables during the model devolopment.

  3 significant variables were determined by the stepwise regression model.

- Cohesiveness optimization of the regression model was calculated as 61.8% which is a low rate.

  Such low rate issue may be solved by increasing the observation times to 10 minutes, lowering the distances between the intervals to 50 meters and increasing the number of the variables.
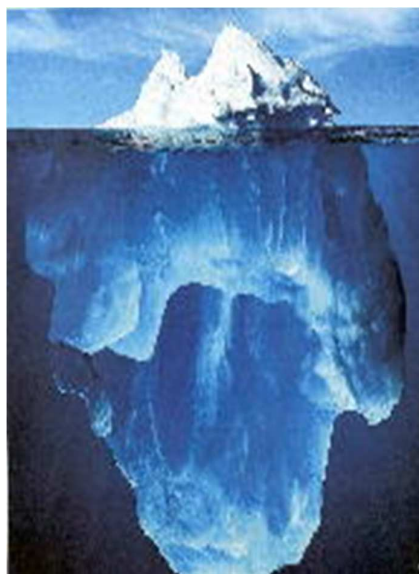
THANK YOU FOR YOUR PATIENCE