"The impact of natural controls on the efficiency of roads network in South Sinai governorate by using Geographic Information System"

South Sinai Governorate is located in the southern part of the Sinai Peninsula between latitudes 27° 45  20 and 29° 25  57 North, and between longitudes 32° 37  58 and 34° 48  59 East, bordered to the north by North Sinai Governorate to the east by the Gulf of Aqaba and to the west by the Gulf of Suez. So it takes the form of a triangle having its base to the north and its head at Ras Mohammed in the south. The total area of the South Sinai Governorate is about 31272 Square kilometers. It is served by paved roads with a total length of 2501 Kilometers.

South Sinai, the field of the present study, has special land forms features that characterize it from the adjacent areas, these include the rugged surface and the mountains that affected passively and forced obligatory paths for the paved roads making them to look like sinuous corridors between the mountains. This rugged landscape has its direct & indirect impact because it increases the cost of road creation to the extent that the cost of construction exceeds the outcome value of use and thus an obstacle to road construction.

This study aims are monitoring the road network in South Sinai and clarifying the impact of the various natural factors and landforms on the path of these roads in the area of study and trying to correlate between such factors and the type, characteristics and density of these roads in the different locations, besides identifying and determining the degree of natural hazards facing these roads which might help in limiting the possible damages if these natural hazards occurred. Also trying to suggest the optimal distribution of these roads according to the developmental plans and the measures that must be undertaken to protect these roads especially in the areas subjected to torrents and falling rocks.

This study shows that the geographical characteristics of the study area had their impact and contribution in the construction and development of the road network. This impact is evident in the fact that many roads have taken the path of faults. Also the steep slopes and relief have had their reflection on road distribution. The climatic characteristics of the study area shows prevalence of the continental climate accompanied by flash floods in spring and fall that is often followed by devastating torrents that lead to road damage and destruction. The north and northeastern wind is the prevailing wind in the study area.

The quantitative analysis of the roads network in South Sinai Governorate showed how the landforms lead to low road density,
increased turns and decreased inter-connections between the roads network roads owing to the mountainous nature of the area, the prevalence of the solid igneous rocks and the increased steep slopes in the southern part. It was apparent that the presence of the roads along the valleys or perpendicular to them, being the most suitable sites for roads amidst mountains, subjected the roads to many problems and hazards.

The study used geographical-based information system remote sensing to identify the dangerous areas in the main roads in southern Sinai like the road bends and curves that increased their length by 205 kilometers than if they were straight especially Newabaa- Raas Al Naqab road and St, Catherine -Feran intersection road. Also these roads become subjected to the dangers of torrents which can cause their damage or even their complete destruction. These methods are also used to locate the areas vulnerable to rock falls and landslide, besides determining the sands drift, sand-storms and dust-storms and suggesting solutions to reduce the impact of these hazards on the roads.

The study monitored the maintenance problems that turned out to be markedly affected by the natural factors like the frequently occurring torrents problem and aggravated by the road network inefficiency and their bad engineering specifications.

The study also cared about assessing and evaluating the efficiency of road services that suffer from paucity of gas stations, rest houses and rescue ambulance units in relation to the roads' length that was found to be at a rate of one unit/51.7 Km. The study also cared about the problem of road accidents which is one of the most important road problems in the study area where the number of accidents rose during the period from 2001 to 2013 at a rate of 17.1% per annual. These accidents were found to be linked to certain areas like Abu-Zenama turns. The study also shows that transport has an important role in the Governorate's Urban and economic developmental processes as it contributes to the growth of economic activities like tourism and mining activity also helps to attract people and link Urban areas to each other, which refers to the need to focus on road network problems and urgent fixing its defaults and shortcomings.