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SPATIAL ANALYSIS OF TRAFFIC CONGESTION OF MONROVIA AND ITS SUBURBS

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IN

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By

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CANDIDATE'S DECLARATION

I, Cooper B. Saysay, Roll No.-2K20/GINF/10 student of the M. Tech (Geoinformatics), hereby declare that the Dissertation titled *Spatial Analysis of Traffic of Monrovia and its Suburbs* which is submitted by me to the multidisciplinary Centre for Geoinformatics, Department of Civil Engineering, Delhi Technological University, Delhi in partial fulfilment of the requirement for the award of the degree of master of Technology is original and not copied from any source without proper citation. This work has not previously formed the basis for the award of any Degree, Diploma Associateship, Fellowship, or other similar title or recognition.

Place: Delhi

COOPER B. SAYSAY

Date:

CERTIFICATE

I hereby certify that the Project Dissertation titled, “SPATIAL ANALYSIS OF TRAFFIC CONGESTION OF MONROVIA AND ITS SUBURBS”, which is submitted by Cooper B. Saysay, 2K20/GINF/10, Multidisciplinary Centre for Geoinformatics, Department of Civil Engineering, Delhi Technological University, Delhi in partial fulfillment of the requirement for the award of the degree of Master of Technology, is a record of the project work carried out by the student under my supervision. To the best of my knowledge, this work has not been submitted in part or full for any Degree or Diploma to this University or elsewhere.

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ABSTRACT

A critical component of the transportation management system (TMS) is to analyse road traffic congestion. Traffic congestion analysis is essential to every developing and developed city. Generally, in urban studies, this analysis is frequently disregarded by TMS. From the literature review, it appears that no GIS-based analysis has been carried out for Monrovia and its suburbs, no plan is available to alleviate the problem of traffic congestion Monrovia and its suburbs, and the road network and its effect on traffic congestion need to analyse Monrovia and its suburbs. Based on this, the geographical examination of traffic congestion in Monrovia and its suburbs has been carried out, since it conveys the character of traffic congestion. Monrovia is the capital of Liberia, which is located in the west of Africa. It serves as the commercial and political capital of Liberia with an approximate population of 1,569,000 in the year 2021. In view of the problem that Monrovia faces with traffic congestion, it was decided to investigate the traffic by using the traffic spatial analysis in conjunction with traffic spatial reliance, and a spatial assortment based on the spatial autocorrelation process, which depicted the Monrovia road network traffic system. Kernel density estimation was also used and the trend surface analysis by using the Moran (I) equation to visualize the traffic parameter in a spatial pattern was used to investigate the traffic. This thesis proposes a traffic-congestion-reduction approach for cities and suburbs. The road network of Monrovia and its suburbs, as well as the traffic zone, has been generated by using ArcGIS. The Data-Interpolating Variation Analysis Geographic Information System is a site that was used to give obtain the administrative boundary and road mark of Liberia in a shapefile form.

Based upon the observation of these results that has been analyse it has been proven using Moran (I) value that s when the moran value is above zero (check I > 0) that means that there is clustered traffic in Monrovia and its suburbs. The study area which is monrovia and suburbs

has lot of traffic congestion from the law of the Moran. From the backdrop it is proposed that the fifteen junction that has been studied need the construction of overhead bridges in Monrovia, installation of GIS based traffic monitor, creation of alternative routes in Monrovia, and traffic light with CCTV should be installed at every junction of Monrovia that will alleviate the trfaffic congestion problem.

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LIST OF ABBREVIATIONS

I. **T & PC** - Taxi and Private Car
II. **SB** - Small Bus
III. **LB** - Large Bus
IV. **ST** - Small Truck
V. **MST** - Medium Size Truck
VI. **LT** - Large Truck,
VII. **VOA** – Voice of America
VIII. **ELWA** - Eternal Love Winning All
IX. **SDA** - Seven Day Advantage
X. **TSD** - Traffic Speed Distribution
XI. **SPI** - Speed Performance Index
XII. **PT** - Public Transit
XIII. **CCTV** – Closed Circuit Television
XIV. **MPRNN** - Message-Passing Recurrent Neural Nets
XV. **DIVA-GIS** - Data-Interpolating Variation Analysis Geographic Information System
XVI. **SAT** - Spatial Analysis of a Traffic
XVII. LISGIS - Liberia Institute of Statistics and Geo-Information Services
XVIII. **W** - Weight
XIX. **W%** - Weight Percent
XX. **AW** - Average Weight Percent
XXI. **Y** - Average of Vehicle passes per month
XXII. **KDE** - Kernel Density Estimation

CHAPTER 1

INTRODUCTION

Traffic congestion is the delay in traffic that causes the slow movement of moving objects (Cars, Trains, etc.). There is a lot of traffic in almost all Urban cities because they are not well planned that is, say every city should have a standard size the population, and roads (Gao et al., 2021). The traffic problem is a worldwide issue that has some trickle-down effect on the economy, citizens' growth, etc. Every environment has its effect based on the size of the traffic, many countries have lost billions from the economy because of traffic congestion. In places like the United States, China, etc. there is always a huge cost per month (Wang & Debbage, 2021c). A traffic monitor is being placed at every highway and street intersection to monitor the traffic. These monitors are used to detect the flow of traffic, these monitors also help the departments of traffic in given road traffic report, the number of a vehicle passing at every event, and track the number of accidents at every interval. For every road, it is important to do the count it (Zhu et al., 2021b).

Traffic congestion supervision has been usually a major factor during transportation formation when it comes to urban measurement. Traffic congestion takes place, when traffic is very slow or when more vehicles are at lower speeds this can increase the traveling time. For short, traffic congestion is a situation that is measured in couple with land use and transportation network (Moyano et al., 2021b). A study has shown that drivers are one of the causes of road traffic congestion. Their driving tactics are more often irregular. They are not patient to follow the right flow of traffic instead they want to take the shorter route to reach their destination. Traffic congestion creates a series of social problems for navigators (Li et al., 2020b). The problem of the high volume of traffic flow is related to road traffic congestion is caused by the following: road network, moving objects, and pedestrians. When there is an increase in population it always has some effect on the traffic condition (Kohan & Ale, 2020).

The first major parts of road assessment are to do an assumption of the marginal cost of road traffic congestion along with the choice of traffic congestion charges. An urban city like China faces regular traffic congestion because there is always an increment in population and when there is an increment in population it always has some negative traffic status (S. Li & Yang, 2017). Traffic speed distribution (TSD) is defined as the direct meaning of pointing out the traffic congestion in couple with spatial and physical means to pinpoint the traffic condition for urban cities. There is a brand new speed performance index (SPI) it has been the introduction and acceptance in couple with the average traffic flow speed and road speed limits it is used to resolve traffic problems of a roadway network (Chen et al., 2020).

Urban transportation system turns to be divided into either periodic transportation system or random transportation system, when it comes to their spatial attributes, it contains two attributes: Firstly, is to do the right one or finalized the mechanism to be converted into action or visual locomotion. This can be mostly explained as a metric of Euclidean field outflow and secondly, it can determine its measure properties. This matches cognitive judgment which is a major aspect of the past judgment on how the population is growing when it comes to the transportation system (Amézquita-López et al., 2021). Traffic congestion is an issue that give embarrassment to various cities. Every city has its technique of handling its issue based upon the type of moving objects in that said environment. A lot of research has shown that based upon your geographical location tells you how to handle your traffic issue (Salazar-Carrillo et al., 2021).

1.1.Urban Planning and Traffic Congestion in Monrovia

Urban planning is a technical and political process concerned with the development and design of land use and the built environment, including air, water, and infrastructure that enters and exits urban areas, such as transportation, communications, and distribution networks, as well as their accessibility (2021). The planning, regulation, and management of towns, cities, and metropolitan regions are all covered under urban planning. It aims to link socio-spatial networks across government and governance levels. For municipal governments, urban planning is an important tool for fostering long-term growth. It distributes economic growth over a region to achieve social objectives and establishes a framework for collaboration among local governments, businesses, and the general public (2021).

Building roads and overhead can also help in stopping the high volume of traffic in Monrovia. Monrovia is not well planned, all vehicles and other moving objects can navigate on the main road which is not necessary for any growing city. There should be an alternative route that will allow another vehicle to use to navigate. Expansion of roads can also help to alleviate traffic problems. Road users need to be comfortable while using the road but most often road users are not comfortable because of the high volume of traffic in Monrovia.

Decentralization of every activity in Monrovia that is, jobs, schools, hospitals, etc. will help in reducing the traffic at every intersection in Monrovia. Because these activities are not decentralized, more people leave the rural settlement to the urban settlement of Liberia (Monrovia) for jobs, schools, medical treatment, etc. just to have better living conditions. Monrovia is not having a standard size population along with international roads standard, and there are commercial vehicles, camion, etc. that will bring about more traffic. Drivers in Monrovia usually drive irregularly, they do not respect traffic law.

1.2. Advantages of Urban planning to Avoid Traffic Congestion

- Cheap carriage charges for trades, as well as lesser carriage prices on behalf of their harvests, is a vital phase, which remained now unique of the key reasons for the spatial responsiveness of trades during economic growth and is nowadays going together with urban planning. Institutions would similarly take a smaller detachment to convey their goods for the reason that everybody survives in the urban. Indifference to countryside regions, most metropolitan regions have satisfactory substructure, which is an additional constituent that drops carriage prices.
- A lesser price of losing a job is another advantage because if somebody misplaces their employment, it resolves to be simpler to pinpoint additional if the metropolitan has a larger number of businesses.
- Exceptional of the rewards of urbanization is the comfort of goods and services. Admission to public health and universal health care is healthier in urban constituencies, which is inadequate in several local regions.
- The procedure of Urban planning increases worker efficiency and provides meant for various public issues.
- Better economic opportunities: since they remain nearer to enterprises and productions, people from the town have extra prospects toward the enhancement of their current salary, moreover through direct dealings with clients or service with the original partnerships.
- Healthier hygienic facilities, by way of drinkable water, hygiene, waste carriage, rubbish reprocessing, and so on.
- An additional benefit of development is that it absorbed people, and tolerates public and traditional incorporation at an equal not possible in countryside settings.

- Interior expansions help the entire culture as the economy propagates, moreover through a bigger duty base or competition between private firms.
- People who would otherwise be doomed to live in poverty with little possibility of improving their situation might benefit from urbanization.
- An additional benefit of expansion is that it quickens the progress of skill. Because of the growing population and international investment, there is a requirement to speed up message, promotion, and dissemination of information.
- Information formation and propagation in a City have a significant role in awareness makes. They similarly perform an important part in its transmission, for the reason that, although living in an additional associated world, the topographical vicinity of the public in a metropolis raises the spread of thoughts.

1.3. Research Gaps

From the researcher's investigation the following gaps were found:

- From the literature review, it appears that no study has been carried out to analyse and understand the problem of traffic congestion.
- Road network and its effect on traffic congestion needs analysis. However, no literature is available for the source on the web.
- No plan is available to alleviate the problem of traffic congestion.
- It appears that no GIS based analysis has been carried out.

1.4.Objectives

a. Carry out a GIS spatial analysis of the causes of traffic congestion in Monrovia city
b. Make a plan to alleviate the current traffic congestion in Monrovia

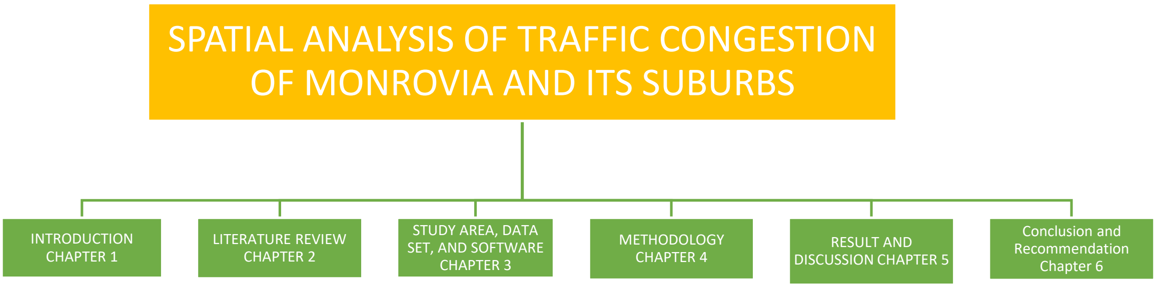
1.5. Organization of Thesis

i. Chapter 1. Introduce the parameters of urban planning and traffic congestion in Monrovia, and advantages of urban planning. After a brief literature review, research gaps have been identified and objectives for the present work has been set.
ii. Chapter 2 gives detailed literature review for the work been conducted.
iii. Chapter 3 gives details information the study area, data set, and software used for analyzing the traffic congestion of Monrovia.
iv. Chapter 4 discuss the methodology of the research which contain spatial analysis of a traffic, spatial autocorrelation exploration and trend surface analysis

v. Chapter 5 provides information on the result and discussion of the research.

vi. Chapter 6 provides information on the conclusion and recommendation for the thesis.

The layout of the chapters has been explained in the below given chart.



CHAPTER 2

LITERATURE REVIEW

The use of one-way connection reconfiguration to redirect traffic from crowded metropolitan areas is advocated as part of a step-by-step methodological approach. Although the primary goal is to minimize traffic congestion in a specific location, this issue has the potential to impact travel times across the whole network. (Karimi et al., 2021).

A study aims to develop a modal shift model for people who desire to convert from driving to walking. Lack of access to public transit is one of the implications of limited PC access. In Kajang, a survey with a sample size of 384 was conducted to investigate people's preferred way of transportation. Congestion on the roads will be decreased, resulting in less pollution and greater safety, as service improvements (more frequent, more refined journeys) and parking costs increase. Because the majority of individuals who use automobiles in this city are young, changing the age of the driver's license will be an excellent approach to assure the use of PT (Abdulrazzaq et al., 2020).

Expressway traffic congestion has a significant detrimental impact on regional growth. Understanding the spatiotemporal patterns of transportation congestion is essential for enhancing product interchange in regional manufacturing. Based on low-cost data, this study presents a novel technique for evaluating traffic congestion (Gao et al., 2021b).

Bad weather, natural disasters, and traffic accidents worsen congestion. The sorts of accidents that occur, as well as the vehicles involved, have an impact on traffic congestion. To find the set of connections in an accident zone, we design a modified version of Dijkstra's technique. We discovered the factors of traffic congestion induced by a traffic collision using actual data from Beijing. These factors include the type of collision, the cars involved, and the time of occurrence. Our approach may be employed in places with comparable traffic circumstances, and different results may be obtainted (Zheng et al., 2020).

Hurricane Irma wreaked havoc across Florida. 7 million people were forced to flee their homes, making it the state's greatest evacuation history. The traffic backups on Florida's evacuation routes were greater than they had been after any previous hurricane. Imperfect predictions and uncertainty about Irma's route caused significant levels of congestion (Ghorbanzadeh et al., 2021).

The worst exaggeration happens in the winding path of high-traffic streets during seasons when meteorological variables exacerbate pollution, according to the World Health Organisation (WHO) report on air pollution (Dasgupta et al., 2021).

It uses machine learning to work outlier detection and anomaly compensating techniques. It also includes a sophisticated architecture for simultaneously forecasting traffic flow, speed, and occupancy on a Sydney motorway (Adriana-Simona Mihaita, Haowen Li, And Marian-Andrei Rizoiu, 2020).

The goal of the study is to look at the interaction between traffic and the built environment, as well as traffic-related and land-use aspects. An extensive investigation of the 24-hour congestion pattern of road segments in a metropolitan region was conducted using fuzzy C-means clustering (Zhang et al., 2017).

This research provides a methodology for dynamically identifying key congestion warning regions from diverse urban road networks, which supports the development of effective perimeter management strategies. Based on the notion of congestion seed intersection, it might capture the formation of new congestion regions. The findings reveal that the suggested algorithms are capable of tracking evolutionary processes and detecting congestion warning areas in a real-world network. The method may accurately capture the spatiotemporal changes in warning communities with varying levels of congestion, particularly overlapping crowded regions. To detect crowded community structures, it might take into account integrated traffic conditions of road links and intersections. The number of congested neighborhoods might change in real-time rather than being predetermined based on past knowledge (Guo et al., 2019).

Research demonstrates how to map traffic congestion inside a metropolitan region using data from an online traffic service. The concept is simple enough to be used in a variety of metropolitan settings, and it can be used in a variety of transportation networks, from subways to highways (Cohen & Gil, 2020).

Researchers examined data from 51 U.S. metro regions over four years to see how they fared in terms of traffic congestion. Poor understanding of socio-demographic and economic factors is one of the most significant challenges of road congestion management, researchers say (Dadashova et al., 2021).

Public transportation (PT) has a variety of effects on the metropolitan road system, including traffic congestion. The purpose of this research is to examine the traffic congestion effects of PT and how they are measured. It also presents a new methodology for analyzing an existing PT system's short-term impacts. According to a study, one of the main advantages of PT is that it reduces traffic congestion. Few studies have looked at the levels of congestion on a roadway where PT and other modes are blended. It is necessary to examine the network-wide effects of PT by taking traffic flow into account (Nguyen-Phuoc et al., 2020).

On sparse yet wide-coverage data, Message-Passing Recurrent Neural Nets (MPRNN) may perform long-term traffic predictions. When projecting forward in 10-minute intervals, MPRNN has the lowest mean error of 0.3 mph. When it comes to projecting traffic speeds for several hours in advance, the algorithm delivers impressive results. We look at historical public vehicle trip data in New York City. Bus speeds are compiled into a traffic segment graph, which depicts the connections between road segments. The MPRNN design is based on a traffic flow graphical representation. The performance of the traffic forecasting system is measured over Manhattan's whole traffic network (2020).

CHAPTER 3

STUDY AREA, DATA USED, AND SOFTWARE

3.1. Study Area

Monrovia and its suburbs are found in Liberia, West Africa. Monrovia and its suburbs are the study area**.** According to the Liberia Institute of Statistics and Geo-Information Service (LISGIS) say that Monrovia's population is about 1,569,000. Based upon the increase in population in Monrovia, has brought about more people owning vehicles and other moving objects, and this city was not meant for a large population. The road that was designed was meant for a little population, not a huge population. The roads are now enclosed with more inhabitants that is thus places that roads were reaching are now enclosed which gave the main streets of Monrovia high traffic volume. Also from central Monrovia to Eternal Love Winning All (ELWA) junction, it is four lanes and the remaining roads from ELWA, Northwest, and Northeast are two lanes. The closer of lanes is one of the problems creating high traffic volume to Monrovia. Figure 3.1. to 3.8 show the following: The Study Area, Monrovia, and its Suburbs in Liberia, the administrative boundary of Liberia and along with the study area, the Road network of Monrovia and its surrounding, the topography of Monrovia, Show the traffic map of Monrovia the street map of Monrovia, Express Highway of Monrovia. And the view of the Monrovia road network

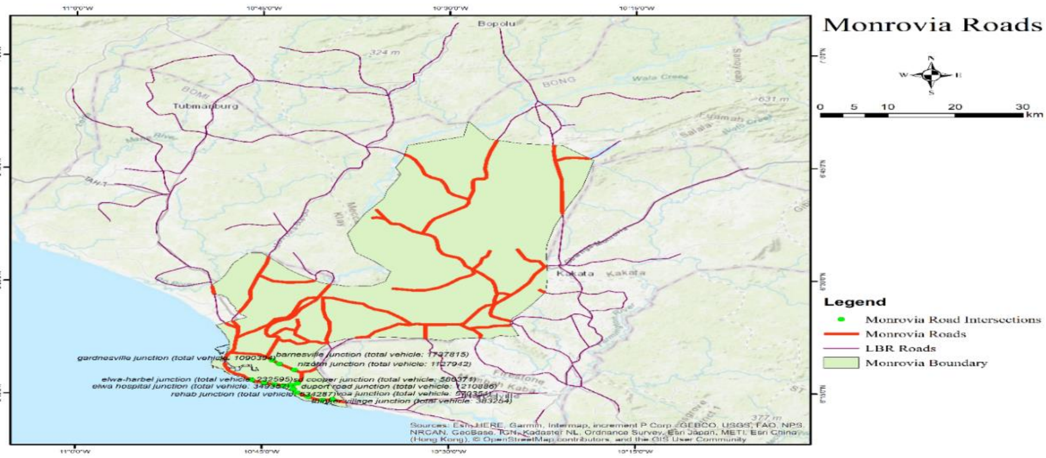


Fig 3.1. Study Area, Monrovia and its Suburbs in Liberia

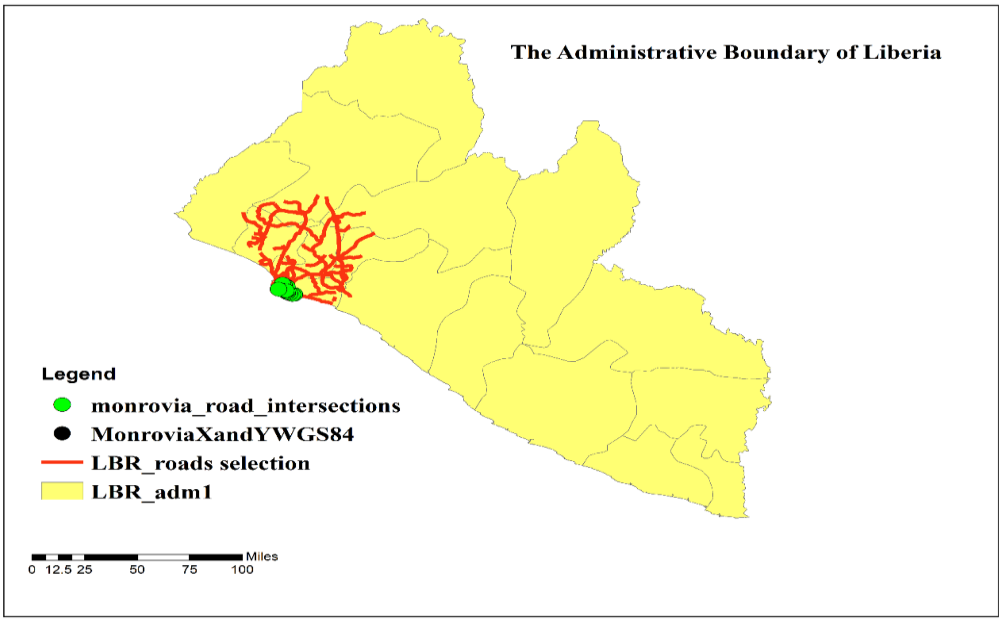


Fig 3.2. Administrative boundary of Liberia and along with the study area

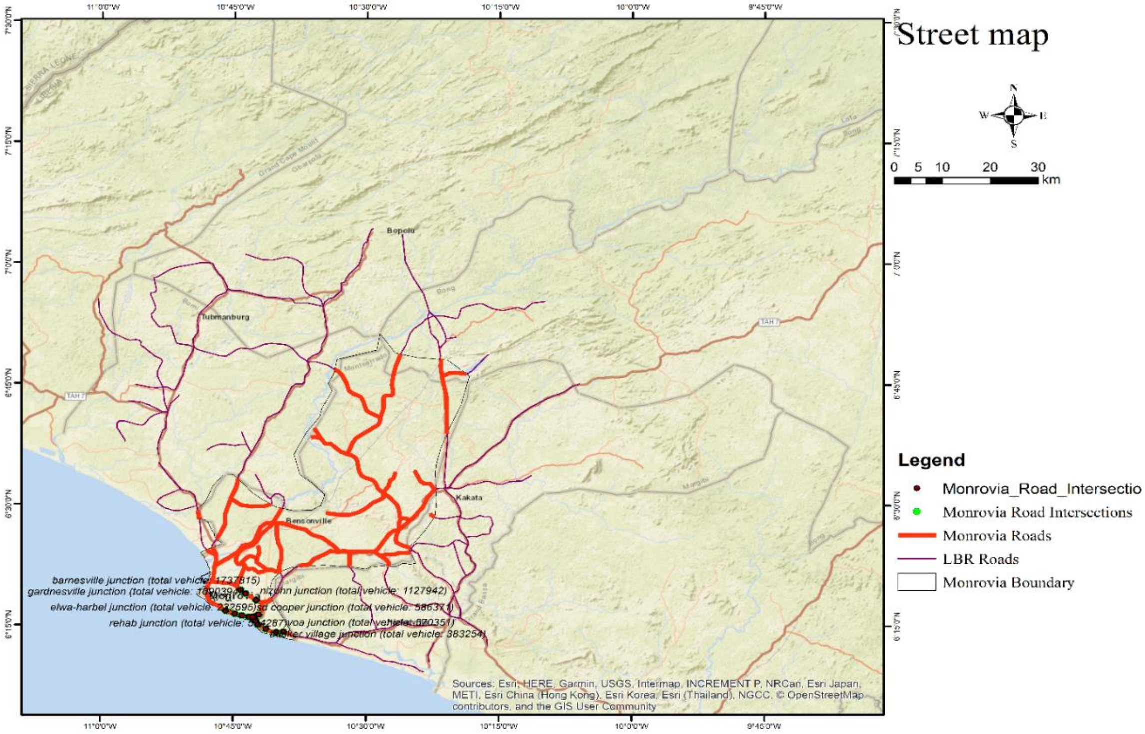


Fig 3.3. Road network of Monrovia and its surrounding

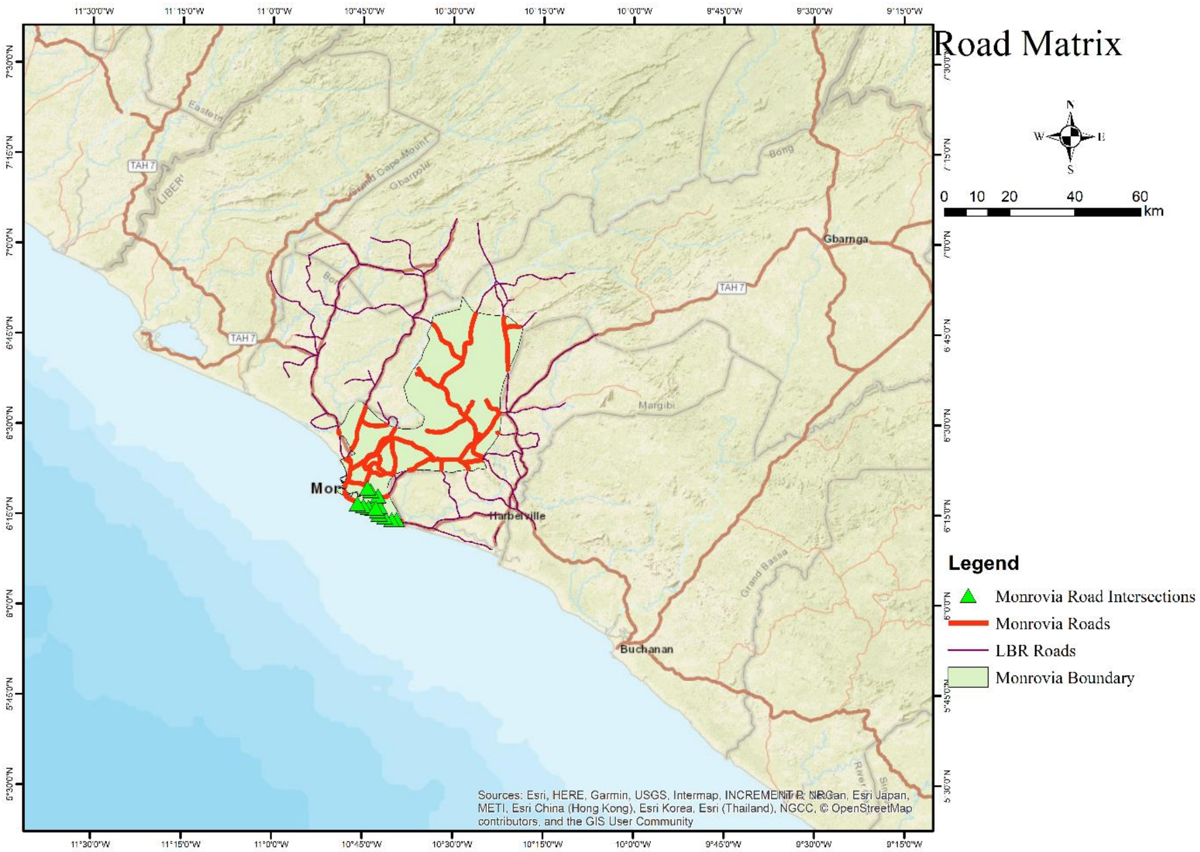


Fig 3.4. The topography of Monrovia

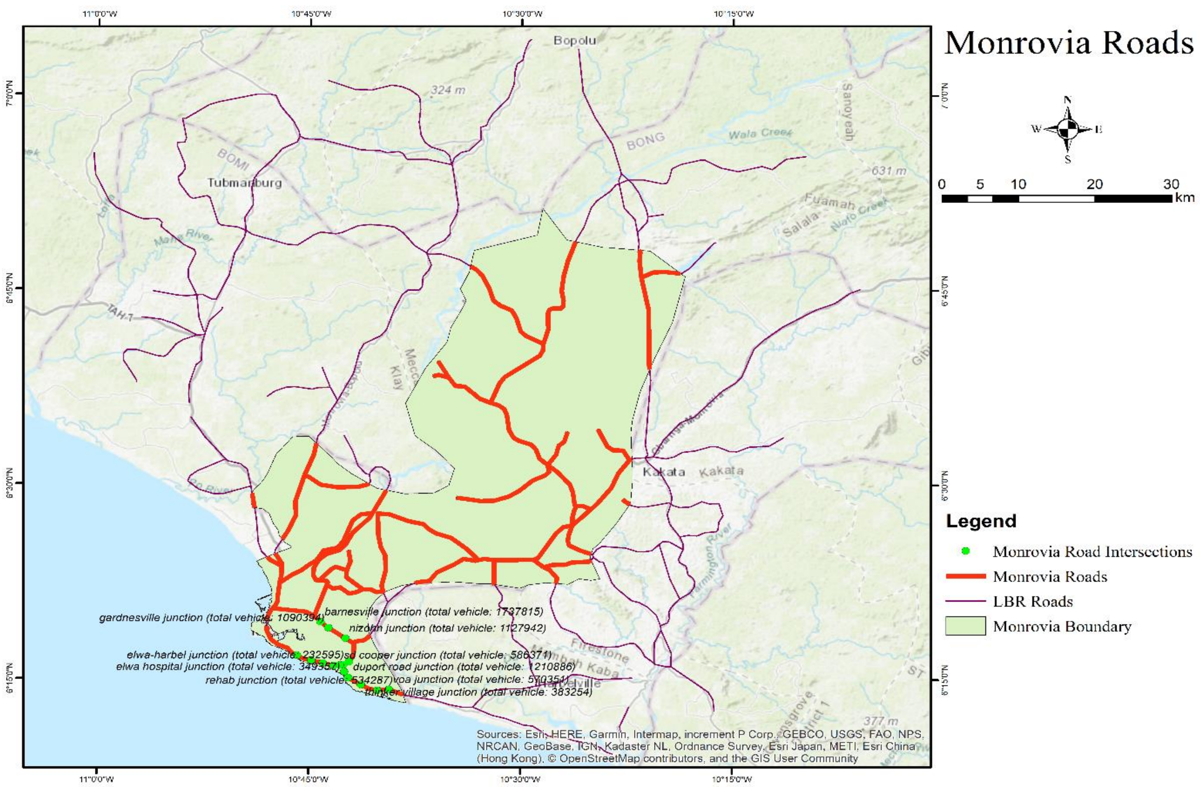


Fig 3.5. Traffic map of Monrovia

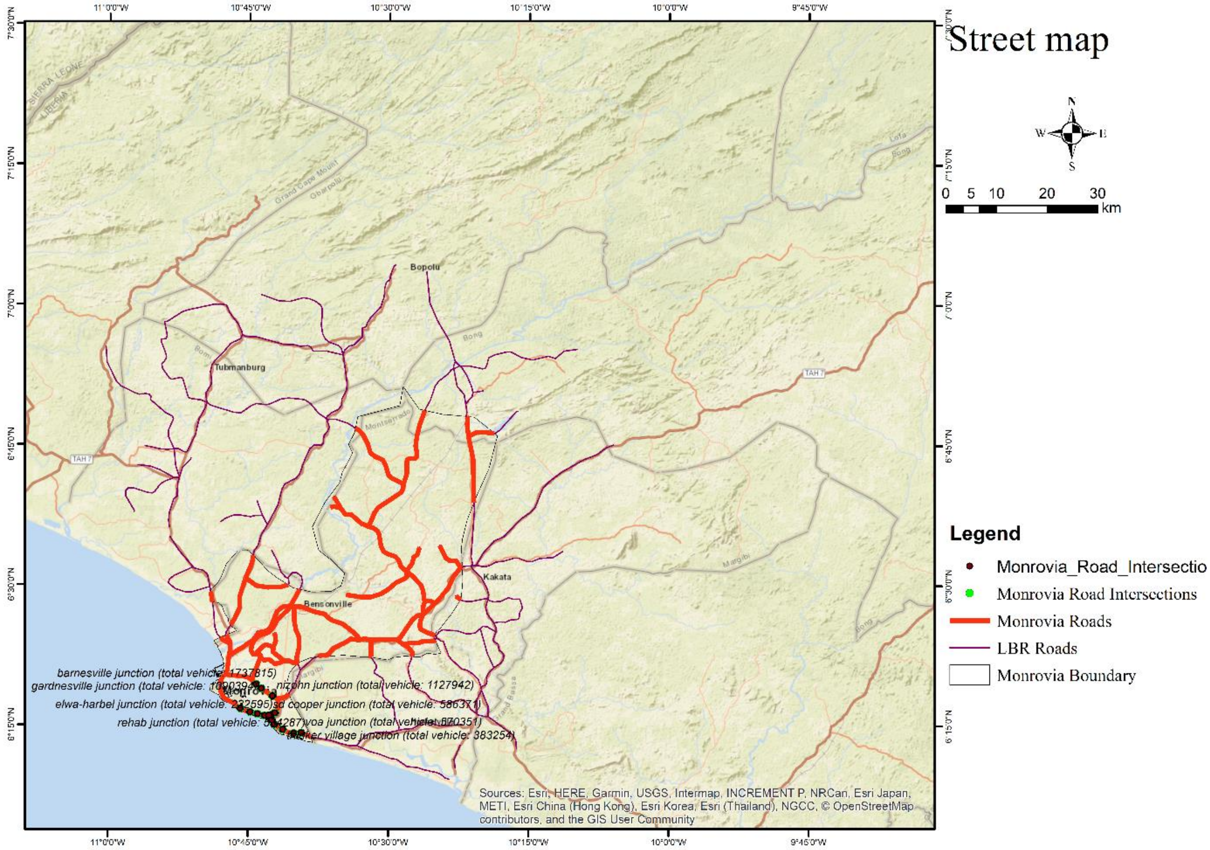


Fig. 3.6. The street map of Monrovia

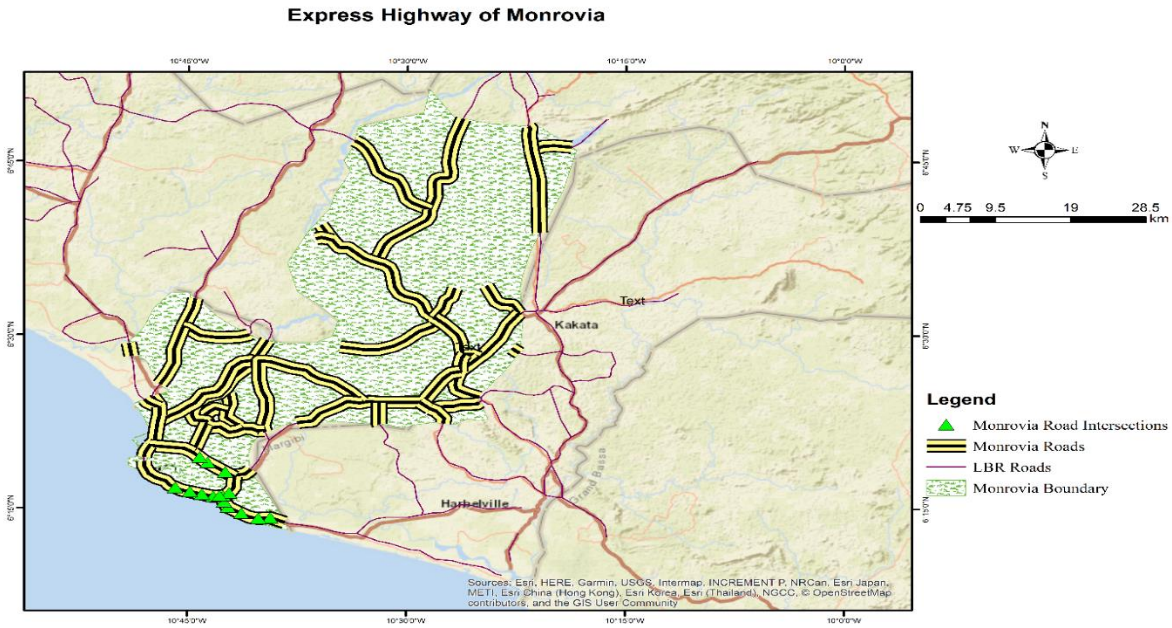


Fig. 3.7. Express Highway of Monrovia.

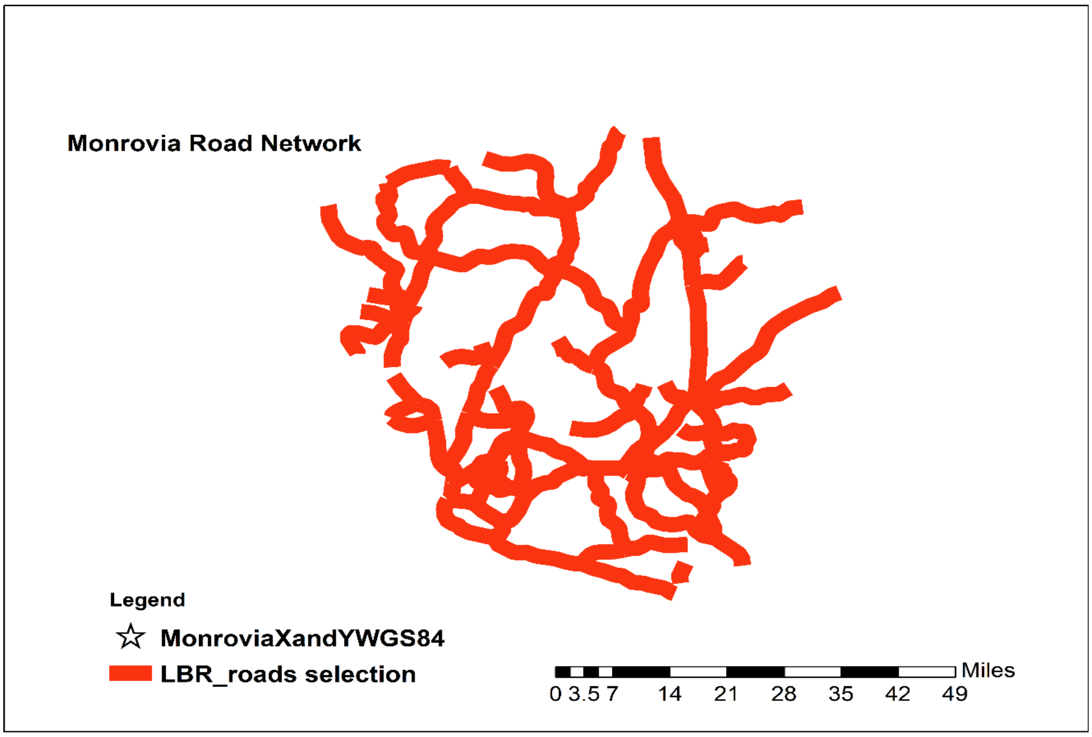


Figure 3.8. View of the Monrovia road network

3.2. Data Used

This section introduces the data on traffic congestion events in Monrovia. We also used the Data-Interpolating Variation Analysis Geographic Information System – DIVA-GIS to get the administrative boundary map and road map of Monrovia. The DIVA-GIS gives us the actual picture of which map to use and it also gives the spatial data of the terrain being studied. The traffic congestion data was collected by a faculty of the department of Civil engineering in real-time at fifteen different locations which are in the below table. We gather our traffic data based on the Monrovia highway along with its suburbs. This data can be called the Monrovia traffic count.

Table 3.1. Names of Junction/Places from where the Traffic Data was collected from July 7, 2021, to August 7, 2021

Voice of America (VOA) Junction Direction	Rehab Junction
Thinker Village Junction	Presidential Church Junction
Eternal Love Winning All (ELWA) Hospital Junction	Eternal Love Winning All (ELWA) -Harbel Junction
Nizohn Junction	Duport Road Junction
Gardnerville Junction	Barnesville Junction

Seven Day Advantage (SDA)	Samuel Kanyan Doe (SKD) Boulevard junction
South Detuwal Cooper Junction Direction	University of Liberia-Executive Mansion
President Bye Pass Junction	

These traffic data were collected based on an Automatic Traffic recorder. This instrument was used to determine the traffic volume at a particular location and time. The time interval was four (4) minutes in Real-time. These data are set to give the information on the speed of each vehicle at a given time, and also the number of lanes gives the information of the number of the vehicle to pass at a given point of intersection.

Table 3.2. One-hour traffic count of Monrovia for different Junction that was collected July 7, 2021

Name of location	T & PC	SB	LB	ST	MST	LT	TOTAL
Voice of America (VOA) Junction Direction	751	19	10	12	9	15	816
Rehab Junction Direction	699	20	20	28	36	15	818
Thinker Village Junction Direction	832	120	123	40	17	19	1151
President Church Junction Direction	823	200	15	54	38	6	1136
Eternal Love Winning All (ELWA) Hospital Junction Direction	706	8	6	8	8	4	740
Eternal Love Winning All (ELWA) -Harbel Junction Direction	170	50	19	18	11	6	274
Duport Road Junction Direction	876	65	28	12	15	8	1004
Nizohn Junction Direction	974	22	15	18	8	19	1056
Gardnerville Junction Direction	730	45	22	6	14	12	829
Barnesville Junction Direction	1220	60	60	24	36	25	1455
Seven Day Advantage (SDA) Junction Direction	230	75	30	23	9	11	378

Samuel Kanyan Doe (SKD) Boulevard Junction	1130	4	3	2	4	3	1146
University of Liberia-Executive Mansion Direction	1245	90	40	12	1	2	1390
South Detuwal Cooper Junction Direction	750	70	17	7	6	2	852
President Bye Pass Junction Direction	180	80	9	11	9	5	294

T & PC = Taxi and Private Car, **SB** = Small Bus, **LB** = Large Bus, **ST** = Small Truck, **MST**= Medium Size Truck, **LT** = Large Truck,

Table 3.3. Eight hours' traffic count of Monrovia for different Junction July 7, 2021

Name of location	**T & PC**	**SB**	**LB**	**ST**	**MST**	**LT**	**TOTAL**
Voice of America (VOA) Junction Direction	5998	80	66	75	45	56	6320
Rehab Junction Direction	5578	287	137	200	256	76	6534
Thinker Village Junction Direction	6645	599	902	278	111	103	8638
President Church Junction Direction	6578	1588	88	345	256	44	8899
Eternal Love Winning All (ELWA) Hospital Junction Direction	5634	43	37	28	27	38	5807
Eternal Love Winning All (ELWA) -Harbel Junction Direction	1345	330	134	134	70	43	2056
Duport Road Junction Direction	6998	476	189	45	87	54	7849
Nizohn Junction Direction	7765	167	98	87	34	45	8196
Gardnerville Junction Direction	5800	323	145	32	90	67	6457
Barnesville Junction Direction	9745	435	434	367	256	178	11415

Seven Day Advantage (SDA) Direction	1745	548	176	123	56	88	2736
Samuel Kanyan Doe (SKD) Boulevard Junction	9012	5	4	1	10	9	9041
University of Liberia-Executive Mansion Direction	9934	675	265	65	0	0	10939
South Detuwal Cooper Junction Direction	6000	560	136	56	48	16	6816
President Bye Pass Junction Direction	14440	640	72	88	72	40	2352

T & PC = Taxi and Private Car, **SB** = Small Bus, **LB** = Large Bus, **ST** = Small Truck, **MST**= Medium Size Truck, **LT** = Large Truck,

Table 3.4. Month traffic count of Monrovia for different Junction that was collected from July 7, 2021, to August 7, 2021

Name of location	T & PC	SB	LB	ST	MST	LT	TOTAL
Voice of America (VOA) Junction Direction	188101	43662	3994	6810	8702	2962	254231
Rehab Junction Direction	8876	15367	548	613	547	553	26504
Thinker Village Junction Direction	250519	6967	66374	31062	6352	666	361940
President Church Junction Direction	203714	47632	1943	7929	5530	1239	267987
Eternal Love Winning All (ELWA) Hospital Junction Direction	178039	845	892	683	630	980	182069
Eternal Love Winning All (ELWA) -Harbel Junction Direction	20968	11705	5564	1467	1349	1147	42200
Duport Road Junction Direction	218070	12582	4447	1502	2814	1615	241030

Nizohn Junction Direction	245142	5713	1964	1486	1736	1784	257825
Gardnerville Junction Direction	175918	13554	4965	1544	1823	1352	199156
Barnesville Junction Direction	309204	12140	10637	11159	8456	3632	355228
Seven Day Advantage (SDA) Direction	56094	19739	1480	6168	2782	1368	87631
Samuel Kanyan Doe (SKD) Boulevard Junction	313919	2867	1035	2217	1397	191	321626
University of Liberia-Executive Mansion Direction	317595	20306	6750	1611	56	23	346341
South Detuwal Cooper Junction Direction	190217	14420	2419	857	940	190	209043
President Bye Pass Junction Direction	41309	17857	650	1853	984	470	63123

T & PC = Taxi and Private Car, **SB** = Small Bus, **LB** = Large Bus, **ST** = Small Truck, **MST**= Medium Size Truck, **LT** = Large Truck,

3.3. Software

For the execution of the approach of spatial analysis of traffic congestion, the ArcGIS is a customer software, server software, and online geographic information system (GIS) facility developed and preserved by Esri. The ArcGIS is used for this purpose: It is an architecture that makes maps and geographic data accessible inside an association through a municipal, and widely on the internet.

CHAPTER 4

METHODOLOGY

4.1.Spatial Analysis of a Traffic

Spatial Analysis of a Traffic (SAT) comprises of series of activities, which can be represented in terms of times interval, and geographical terrain. Because traffic data is often aggregated and clustered rather than spread randomly over a road network, traffic spatial reliance (dependency) and assortment (heterogeneity) are two important elements to consider when analyzing the road traffic data of Monrovia. According to Waldo Tobler's First Law of Geography, " spatial dependency theory everything is connected to everything else, but close things are more related than distant things." (de Ab1reu, 2018). Spatial reliance coincides with heterogeneity. In this thesis, we introduce spatial analysis of traffic (SAT) to know the causes of traffic and how to solve such a problem in the real world.

4.2. Spatial autocorrelation exploration

The term "spatial autocorrelation" refers to the study of how well things in a given region correlate with one other. When numerous identical values are discovered close together, positive autocorrelation occurs, and when extremely diverse outcomes are found close together, negative autocorrelation develops (Peng et al., 2021a). This thesis uses ArcGIS to implement the spatial autocorrelation analysis of congested traffic routes and non-congested traffic routs in Monrovia.

Moran's (I) is a spatial correlation metric. Spatial autocorrelation is the correlation of a signal with its surroundings in space. It is more challenging since it integrates multi-dimensional (2 or 3 dimensions of space) and multi-directional signals (Peng et al., 2021b). The mathematical representation of Moran I theory:

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \quad \sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij}} = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij} \ \ y^T y} \qquad 1$$

I stand for the global spatial autocorrelation index; y is the average value of this attribute value; y is the observed value of a given spatial unit. The number of regional units is n. where ω_{ij} is the spatial weighting coefficient matrix, which reflects the connection between two points in the neighborhood.

Note:

- When the Moran (I) value is exactly zero then the traffic is dispersed (Peng et al., 2021).
- When the Moran (I) value is a negative one then the traffic is perfectly dispersed (Peng et al., 2021).
- When the Moran (I) value is above zero that is 0.1 traffic is clustering (Peng et al., 2021).
- When the Moran (I) value is exactly one then the traffic is perfectly clustering (Peng et al., 2021).

4.3.Trend surface analysis

The continuous function is used to match the observed data in trend surface analysis, which is extensively used to analyse data in map form. Kernel density estimation is a popular density estimate approach (KDE). A non-parameter statistic is used for surface analysis. It visualizes spatial patterns using a density graph and may be used to analyse the characteristics of geographical information distribution (Li et al., 2020). The below equation is used to analyse the KDE

$$\hat{F}(x,y,t) = \frac{1}{nh_x h_y h_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t}) \qquad 2$$

where $K_{x,y}$ and K_t are the spatial and temporal kernel functions, respectively; h_x, h_y, and h_t are spatial and temporal bandwidths, respectively.

For continuous multivariate data, the Gaussian kernel model is one of the most frequently used nonparametric density models. In this model, there are no assumptions about the density's parametric form (Li et al., 2020). As a result, the multivariate Gaussian kernel is used in this research, which is provided by:

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma}) \qquad 3$$

And

$$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2}) \qquad 4$$

Every dimension has a zero mean and equal standard deviations.

The density value $\hat{F}(x,y,t)$ is calculated from each data point $(x_i y_i t_i)$ and weighted using the kernel functions Eq. (3) and Eq. (4). In other words, the weighted-density value of the data points is determined by the spatial analysis kernel function centered on each interval after the entire spatial analysis area has been partitioned into tiny grid intervals.

The congestion parameter to be modeled is fixed, and both highway and traffic parameters are to be considered. After determining the desired data input, data was collected on-site using a traffic count record node-based traffic metrics and a moving car method to determine the actual journey duration.

In this thesis, we are saying that taxi, buses, etc. should have their routes. When these locomotion objects have their routes it will help in getting away some of the high volumes of traffic outflow daily. There should be street remote sensing monitors place at every intersection to tell drivers and pedestrians when to leave if traffic lights authorize them. Government should make overhead bridges at every major intersection to alleviate the high flow of traffic volume. There should be additional lanes added to the current one (in Monrovia there are lots of streets that were built as two lanes).

CHAPTER 5

RESULTS AND DISCUSSIONS

In this study, some traffic areas of Monrovia Liberia have been investegated. The report from the Liberia census of Monrovia that was conducted by the Liberia Institute of Statistics and Geo-Information Services (LISGIS) says that the population of Monrovia is approximately 1,623,000 and the area of Monrovia is 194.2km^2. Vehicles owners and users are on a large scale. Grouped numerous things into categories to study traffic conditions over time. all the data have been gathered from sunrise to evening on working and non-working days.

One-hour result of the traffic of Monrovia and its Suburbs

One-hour value of Moran (I), and Kernel {{ K and Trend Surface F(x,y,t)} shown in table 5.1 while detail calculation are shown in the appendix

Table 5.1. Eight-hours Value of Moran (I) and kernel { k(t), K(x,y), and Trend Surface F(x,y,t)}

Name	I	K(t)	K(x,y)	F(x,y,t)
Voice of America (VOA) Junction Direction	0.181	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Rehab Junction Direction	0.195	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Thinker Village Junction Direction	0.231	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
President Church Junction Direction	0.230	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Eternal Love Winning All (ELWA) Hospital Junction Direction	0.175	1.008	0.44694	0.0001787 0.003575 0.0000000000005146

Eternal Love Winning All (ELWA) - Harbel Junction Direction	0.269	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Duport Road Junction Direction	0.191	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Nizohn Junction Direction	0.181	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Gardnerville Junction Direction	0.189	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Barnesville Junction Direction	0.189	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Seven Day Advantage (SDA) Junction Direction	0.274	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Samuel Kanyan Doe (SKD) Boulevard Junction	0.169	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
University of Liberia-Executive Mansion Direction	0.186	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
South Detuwal Cooper Junction Direction	0.189	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
President Bye Pass Junction Direction	0.271	1.008	0.44694	0.0001787 0.003575 0.0000000000005146

Eight-hours result of the traffic of Monrovia and its suburbs

Eight-hours value of Moran (I), and Kernel {{ K and Trend Surface F(x,y,t)} shown in table 5.2 while detail calculation are shown in the appendix

Table 5.2 Eight-hours Value of Moran (I) and kernel { k(t), K(x,y), and Trend Surface F(x,y,t)]

Name	I	K(t)	K(x,y)	F(x,y,t)
Voice of America (VOA) Junction Direction	0.177	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Rehab Junction Direction	0.195	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Thinker Village Junction Direction	0.217	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
President Church Junction Direction	0.225	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Eternal Love Winning All (ELWA) Hospital Junction Direction	0.172	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Eternal Love Winning All (ELWA) - Harbel Junction Direction	0.225	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Duport Road Junction Direction	0.187	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Nizohn Junction Direction	0.176	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Gardnerville Junction Direction	0.186	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Barnesville Junction Direction	0.195	1.674	0.00808	0.00009695 0.0001066 0.0000000015498

Seven Day Advantage (SDA) Junction Direction	0.261	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Samuel Kanyan Doe (SKD) Boulevard Junction	0.167	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
University of Liberia-Executive Mansion Direction	0.184	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
South Detuwal Cooper Junction Direction	0.189	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
President Bye Pass Junction Direction	0.270	1.674	0.00808	0.00009695 0.0001066 0.0000000015498

One month result of the traffic of Monrovia and its suburbs

One-month value of Moran (I), and Kernel {{ K and Trend Surface F(x,y,t)} shown in table 5.3 while detail calculation are shown in the appendix

Table 5.3. One month Value of Moran (I) and kernel { k(t), K(x,y), and Trend Surface F(x,y,t)]

Name	I	K(t)	K(x,y)	F(x,y,t)
Voice of America (VOA) Junction Direction	0.225	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Rehab Junction Direction	0.287	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Thinker Village Junction Direction	0.242	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
President Church Junction Direction	0.219	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$

Eternal Love Winning All (ELWA) Hospital Junction Direction	0.170	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Eternal Love Winning All (ELWA) - Harbel Junction Direction	0.335	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Duport Road Junction Direction	0.335	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Nizohn Junction Direction	0.184	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Gardnerville Junction Direction	0.185	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Barnesville Junction Direction	0.189	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Seven Day Advantage (SDA) Junction Direction	0.260	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Samuel Kanyan Doe (SKD) Boulevard Junction	0.171	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
University of Liberia-Executive Mansion Direction	0.182	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
South Detuwal Cooper Junction Direction	0.183	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
President Bye Pass Junction Direction	0.235	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$

Based upon the observation of these results that is been analyse it has been proven by the Moran (I) value that says when the moran value is above zero (check I > 0) that means that there is clustered traffic in Monrovia and its suburbs. The study area which is monrovia and suburbs has lot of traffic congestion from the law of the Moran. From the backdrop it is proposed that the fifteen junction that has been understand need have the following in order to alleviate the traffic in Monrovia.

- The construction of overhead bridges at all the fifteen junction of monrovia.
- Installat GIS based traffic monitor.
- Creation of alternative routes in Monrovia.
- Traffic light with CCTV should be installed at every junction of Monrovia.

CONCLUSION AND RECOMMENDATION

Researchers can use spatial analysis to look into traffic conditions at the highway network level. This study covers spatial investigation theory and approaches for analyzing traffic data, such as spatial autocorrelation analysis and trend surface analysis, as well as spatial analysis of the Monrovia transportation network. An investigation based on real-world data reveals that Monrovia traffic flow is geographically dependent and variable.

Monrovia traffic flow states have a local aggregation characteristic that is subjected to both street link position and linkage layout. In all geographical traffic status measures, all-time factors are provided.

The relationship between a street linkage's spatial organization in addition to its traffic flow situation is a potentially important but understudied issue. This research addresses geographical concerns to investigate the Monrovia transportation system. It may be used to locate hotspots on the Monrovia road network as well as analyse the general concert of the Monrovia traffic flow classification, which is valuable for both active traffic flow control in addition to lasting Monrovia traffic and preparation.

In this work, the following recommendation are made:

- Creation of series of routes to cut down traffic congestion in Monrovia and its suburbs
- Construction of overhead bridges to every critical junction that always has more traffic such: as S.K.D Boulevard, ELWA Junction, etc.
- Government should design lanes for smaller vehicles and large vehicles
- Install more traffic lights to control the movement of vehicles at a time
- Lanes seize should be increased based upon the location of the terrain that is the population, vehicle owners, etc.
- Install more street camera for the monitor of traffic.

Further studies in this area may also be considered to explore more details and understand the reasons of traffic congestion in Monrovia and make efforts to alleviate the situation.

[1] Gao, H., Yan, Z., Hu, X., Yu, Z., Luo, W., Yuan, L., & Zhang, J. (2021). A Method for Exploring and Analyzing Spatiotemporal Patterns of Traffic Congestion in Expressway Networks Based on Origin–Destination Data. *ISPRS International Journal of Geo-Information*, *10*(5), 288. https://doi.org/10.3390/ijgi10050288

[2] Wang, M., & Debbage, N. (2021c). Urban morphology and traffic congestion: Longitudinal evidence from US cities. *Computers, Environment and Urban Systems*, *89*, 101676. https://doi.org/10.1016/j.compenvurbsys.2021.101676

[3] Zhu, S., Ding, R., Zhang, M., van Hentenryck, P., & Xie, Y. (2021a). Spatio-Temporal Point Processes with Attention for Traffic Congestion Event Modeling. *IEEE Transactions on Intelligent Transportation Systems*, 1–12. https://doi.org/10.1109/tits.2021.3068139

[4] Moyano, A., Stępniak, M., Moya-Gómez, B., & García-Palomares, J. C. (2021a). Traffic congestion and economic context: changes of spatiotemporal patterns of traffic travel times during crisis and post-crisis periods. *Transportation*, *48*(6), 3301–3324. https://doi.org/10.1007/s11116-021-10170-y

[5] Li, G., Lai, W., Sui, X., Li, X., Qu, X., Zhang, T., & Li, Y. (2020b). Influence of traffic congestion on driver behavior in post-congestion driving. *Accident Analysis & Prevention*, *141*, 105508. https://doi.org/10.1016/j.aap.2020.105508

[6] Kohan, M., & Ale, J. M. (2020). Discovering traffic congestion through traffic flow patterns generated by moving object trajectories. *Computers, Environment and Urban Systems*, *80*, 101426. https://doi.org/10.1016/j.compenvurbsys.2019.101426

[7] Li, S., & Yang, J. (2017). The Marginal Cost of Traffic Congestion and Road Pricing: Evidence from a Natural Experiment in Beijing. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2948619

[8] Chen, Y., Chen, C., Wu, Q., Ma, J., Zhang, G., & Milton, J. (2020). Spatial-temporal traffic congestion identification and correlation extraction using floating car data. *Journal of Intelligent Transportation Systems*, *25*(3), 263–280. https://doi.org/10.1080/15472450.2020.1790364

[9] Amézquita-López, J., Valdés-Atencio, J., & Angulo-García, D. (2021). Understanding Traffic Congestion via Network Analysis, Agent Modeling, and the Trajectory of

Urban Expansion: A Coastal City Case. *Infrastructures*, *6*(6), 85. https://doi.org/10.3390/infrastructures6060085

[10] Salazar-Carrillo, J., Torres-Ruiz, M., Davis, C. A., Quintero, R., Moreno-Ibarra, M., & Guzmán, G. (2021). Traffic Congestion Analysis Based on a Web-GIS and Data Mining of Traffic Events from Twitter. *Sensors*, *21*(9), 2964. https://doi.org/10.3390/s21092964

[11] Zaki, J. F., Ali-Eldin, A., Hussein, S. E., Saraya, S. F., & Areed, F. F. (2020). Traffic congestion prediction based on Hidden Markov Models and contrast measure. *Ain Shams Engineering Journal*, *11*(3), 535–551. https://doi.org/10.1016/j.asej.2019.10.006

[12] Abdulrazzaq, L. R., Abdulkareem, M. N., Mat Yazid, M. R., Borhan, M. N., & Mahdi, M. S. (2020). Traffic Congestion: Shift from Private Car to Public Transportation. *Civil Engineering Journal*, *6*(8), 1547–1554. https://doi.org/10.28991/cej-2020-03091566

[13] Zheng, Z., Wang, Z., Zhu, L., & Jiang, H. (2020). Determinants of the congestion caused by a traffic accident in urban road networks. *Accident Analysis & Prevention*, *136*, 105327. https://doi.org/10.1016/j.aap.2019.105327

[14] Adriana-Simona Mihaita, Haowen Li And Marian-Andrei Rizoiu. (2020). Traffic congestion anomaly detection and prediction using deep learning. *Traffic Congestion Anomaly Detection and Prediction Using Deep Learning*, *arXiv:2006.13215vl*, 1–25.

[15] Cohen, J., & Gil, J. (2020). Mapping the spatial distribution of the effects of urban traffic congestion: methodological exploration using web based services. *IOP Conference Series: Earth and Environmental Science*, *588*(3), 032059. https://doi.org/10.1088/1755-1315/588/3/032059

[16] Dasgupta, S., Lall, S., & Wheeler, D. (2021). Spatiotemporal analysis of traffic congestion, air pollution, and exposure vulnerability in Tanzania. *Science of The Total Environment*, *778*, 147114. https://doi.org/10.1016/j.scitotenv.2021.147114

[17] Gao, H., Yan, Z., Hu, X., Yu, Z., Luo, W., Yuan, L., & Zhang, J. (2021b). A Method for Exploring and Analyzing Spatiotemporal Patterns of Traffic Congestion in Expressway Networks Based on Origin–Destination Data. *ISPRS International Journal of Geo-Information*, *10*(5), 288. https://doi.org/10.3390/ijgi10050288

[18] Zhang, K., Sun, D. J., Shen, S., & Zhu, Y. (2017). Analyzing spatiotemporal congestion pattern on urban roads based on taxi GPS data. *Journal of Transport and Land Use*, *10*(1). https://doi.org/10.5198/jtlu.2017.954

[19] Dadashova, B., Li, X., Turner, S., & Koeneman, P. (2021). Multivariate time series analysis of traffic congestion measures in urban areas as they relate to socioeconomic indicators. *Socio-Economic Planning Sciences*, *75*, 100877. https://doi.org/10.1016/j.seps.2020.100877

[20] Ghorbanzadeh, M., Burns, S., Rugminiamma, L. V. N., Erman Ozguven, E., & Huang, W. (2021). Spatiotemporal Analysis of Highway Traffic Patterns in Hurricane Irma Evacuation. *Transportation Research Record: Journal of the Transportation Research Board*, *2675*(9), 321–334. https://doi.org/10.1177/03611981211001870

[21] Karimi, H., Ghadirifaraz, B., Shetab Boushehri, S. N., Hosseininasab, S. M., & Rafiei, N. (2021). Reducing traffic congestion and increasing sustainability in special urban areas through one-way traffic reconfiguration. *Transportation*, *49*(1), 37–60. https://doi.org/10.1007/s11116-020-10162-4

[22] Nguyen-Phuoc, D. Q., Young, W., Currie, G., & de Gruyter, C. (2020). Traffic congestion relief associated with public transport: state-of-the-art. *Public Transport*, *12*(2), 455–481. https://doi.org/10.1007/s12469-020-00231-3

[23] S.R.I.U.A.L.S. (2020). Forecasting Sparse Traffic Congestion Patterns Using Message-Passing RNNS. *IEEE*, 1–166. https://doi.org/10.1109/ICASSP40776.2020.9052963

[24] Guo, Y., Yang, L., Hao, S., & Gao, J. (2019). Dynamic identification of urban traffic congestion warning communities in heterogeneous networks. *Physica A: Statistical Mechanics and Its Applications*, *522*, 98–111. https://doi.org/10.1016/j.physa.2019.01.139

[25] de Abreu, J. F. (2018). First law of geography, first computer map, cartograms, analytical cartography, wind model – tribute to Waldo Tobler: scientist, geographer, cartographer. *Annals of GIS*, *24*(3), 221–222. https://doi.org/10.1080/19475683.2018.1471521

[26] Altaweel, M. (2017, May 30). *GIS and Spatial Autocorrelation*. GIS Lounge. https://www.gislounge.com/gis-spatial-autocorrelation/#:%7E:text=Spatial%20autocorrelation%20is%20simply%20looking%20at%20how%20well,very%20different%20results%20are%20found%20near%20each%20other.

[27] Peng, Q., Li, J., Wang, Y., Zhao, L., Tan, J., & He, C. (2021). Temporal and Spatial Distribution Characteristics of NOx Emissions of City Buses on Real Road Based on Spatial Autocorrelation. *Aerosol and Air Quality Research*, *21*(6), 200059. https://doi.org/10.4209/aaqr.200059

[28] Li, Y., Abdel-Aty, M., Yuan, J., Cheng, Z., & Lu, J. (2020). Analyzing traffic violation behavior at urban intersections: A spatio-temporal kernel density estimation approach using automated enforcement system data. *Accident Analysis & Prevention*, *141*, 105509. https://doi.org/10.1016/j.aap.2020.105509

[29] A. (2021, March 11). *What is Urban Planning? What do Urban Planners Do?* Construction Placements. https://www.constructionplacements.com/what-is-urban-planning-what-do-urban-planners-do/#:%7E:text=Urban%20planners%20typically%20do%20the%20following%3A%201%20Meet,and%20studies%206%20Conduct%20inspections%20More%20items. . .%20

APPENDIX 1

CALCULATION OF ONE-HOUR TRAFFIC COUNT STATISTICS

Voice of Africa Junction direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	751	0.9203431	92.034314		1.0865513
SB	19	0.0232843	2.3284314		42.947368
LB	10	0.0122549	1.2254902		81.6
ST	12	0.0147059	1.4705882		68
MST	9	0.0110294	1.1029412		90.666667
LT	15	0.0183824	1.8382353		54.4
		1	100	100	
TOTAL	816				

T & PC= Taxi and Private Car, **W=** Weight, **W%=**Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \ \sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij}} = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.086)^{1hr}(100)(1.086)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 92.033 \ \ (1.086)^{1hr}(1.086)}$$

$$I = \frac{6 \ (1.086)^{1hr}(100)(1.086)}{(6)(6)(92.033)(1.086)^{1hr}(1.086)}$$

$$I = \frac{(100)}{(6)(92.033)}$$

$$I = 0.181$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998} \exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904) \exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x,y)$

Table 2. the Motion and displacement Traffic count of VOA Junction

Time (second)	**Speed (m/sec)**	**X (meter)**	**Acceleration (m/sec2)**	**Y = X + Vt**
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904) \exp\left(-\frac{100^2}{2(200)^2}\right) \exp(-\frac{200^2}{2(200)^2})$$

$$K_{x,y}(x,y) = (0.039904) \exp(-0.125) \exp(-2)$$

$$K_{x,y}(x,y) = 1.49579 exp(-2)$$

$$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.44694/sec^4 [\frac{100}{10}, \frac{200}{10}] 1.008/hr^2 (\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.44694/sec^4[(10),(20)],1.008/hr^2\,\frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 3**.** One-hour Arithmetic Traffic count of Rehab Junction

Rehab Junction direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	699	0.854523	85.45232		1.170243
SB	20	0.02445	2.444988		40.9
LB	20	0.02445	2.444988		40.9
ST	28	0.03423	3.422983		29.21429
MST	36	0.04401	4.400978		22.72222
LT	15	0.018337	1.833741		54.53333
		1	100	100	
TOTAL	818				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ \ (1.086)^{1hr}(100)(1.086)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 92.033\ \ (1.086)^{1hr}(1.086)}$$

$$I = \frac{6\ \ (1.170)^{1hr}(100)(1.170)}{(6)(6)(85.452)(1.170)^{1hr}(1.170)}$$

$$I = \frac{(100)}{(6)(85.452)}$$

$$I = \ 0.195$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998} \exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904) \exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x, y)$

Table 4. Motion and displacement Traffic count of Rehab Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{100^2}{2(200)^2}\right) \exp(-\frac{200^2}{2(200)^2})$$

$$K_{x,y}(x, y) = (0.039904) \exp(-0.125) \exp(-2)$$

$$K_{x,y}(x, y) = 1.49579 exp(-2)$$

$$\boxed{K_{x,y}(x, y) = 0.44694/sec^4}$$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.44694/sec^4 [\frac{100}{10}, \frac{200}{10}] 1.008/hr^2 (\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5} \sum_{i=1}^{6} 0.44694/sec^4 [(10), (20)], 1.008/hr^2 \frac{12960000 sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5} \sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 5. One-hour Arithmetic Traffic count of Thinker Village Junction

Thinker Village Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	832	0.72285	72.28497		1.383413
SB	120	0.104257	10.42572		9.591667
LB	123	0.106864	10.68636		9.357724
ST	40	0.034752	3.475239		28.775
MST	17	0.01477	1.476977		67.70588
LT	19	0.016507	1.650738		60.57895
		1	100	100	
TOTAL	1151				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

$$I = \frac{n \sum_{i=1}^{n} \sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \ \sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ \ (1.383)^{1hr}(100)(1.383)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 72.284\ (1.383)^{1hr}(1.383)}$$

$$I = \frac{6\ \ (1.383)^{1hr}(100)(1.383)}{(6)(6)72.284\ (1.383)^{1hr}(1.383)}$$

$$I = \frac{(100)}{(6)(72.283)}$$

$$I = \ 0.231$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$

$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(1hr)^2}{2(200)})$

$K_t(t) = \frac{1}{25.05998} \exp(-\frac{1hr^2}{400})$

$K_t(t) = (0.039904) \exp(-0.0025)$

$K_t(t) = 1.008/hr^2$

Solution of $K_{x,y}(x,y)$

Table 6. Motion and displacement Traffic count of Thinker Village Junction

Time (second)	**Speed (m/sec)**	**X (meter)**	**Acceleration (m/sec2)**	**Y = X + Vt**
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904) \exp\left(-\frac{100^2}{2(200)^2}\right) \exp(-\frac{200^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904) \exp(-0.125) \exp(-2)$

$K_{x,y}(x,y) = 1.49579 exp(-2)$

$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.44694/sec^4 [\frac{100}{10}, \frac{200}{10}] 1.008/hr^2 (\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.44694/sec^4[(10),(20)],1.008/hr^2\,\frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 7. One-hour Arithmetic Traffic count of President Church Junction

President Church Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	823	0.7244718	72.447183		1.3803159
SB	200	0.1760563	17.605634		5.68
LB	15	0.0132042	1.3204225		75.733333
ST	54	0.0475352	4.7535211		21.037037
MST	38	0.0334507	3.3450704		29.894737
LT	6	0.0052817	0.528169		189.33333
		1	100	100	
TOTAL	1136				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i-y)(y_j-y)}{\sum_{i=1}^{n}(y_i-y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{6\ \ (1.380)^{1hr}(100)(1.380)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 72.447(1.380)^{1hr}(1.380)}$$

$$I = \frac{6\ \ (1.380)^{1hr}(100)(1.380)}{(6)(6)72.447(1.380)^{1hr}(1.380)}$$

$$I = \frac{(100)}{(6)(72.447)}$$

$$I = \ 0.230$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998} \exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904) \exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x,y)$

Table 8. Motion and displacement Traffic count of President Church Junction

Time (second)	**Speed (m/sec)**	**X (meter)**	**Acceleration (m/sec2)**	**Y = X + Vt**
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904) \exp\left(-\frac{100^2}{2(200)^2}\right) \exp(-\frac{200^2}{2(200)^2})$$

$$K_{x,y}(x,y) = (0.039904) \exp(-0.125) \exp(-2)$$

$$K_{x,y}(x,y) = 1.49579 exp(-2)$$

$$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.44694/sec^4 [\frac{100}{10}, \frac{200}{10}] 1.008/hr^2 (\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.44694/sec^4[(10),(20)],1.008/hr^2\,\frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 9. One-hour Arithmetic Traffic count of ELWA-Hospital Junction

Eternal Love Winning All –Hospital Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	706	0.954054	95.40541		1.048159
SB	8	0.010811	1.081081		92.5
LB	6	0.008108	0.810811		123.3333
ST	8	0.010811	1.081081		92.5
MST	8	0.010811	1.081081		92.5
LT	4	0.00540541	0.540541		185
		1	100	100	
TOTAL	740				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i-y)(y_j-y)}{\sum_{i=1}^{n}(y_i-y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{6\ (1.048)^{1hr}(100)(1.048)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 95.405\ (1.048)^{1hr}(1.048)}$$

$$I = \frac{6\ (1.048)^{1hr}(100)(1.048)}{(6)(6)95.405\ (1.048)^{1hr}(1.048)}$$

$$I = \frac{(100)}{(6)(95.405)}$$

$$I = 0.175$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$

$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(1hr)^2}{2(200)})$

$K_t(t) = \frac{1}{25.05998} \exp(-\frac{1hr^2}{400})$

$K_t(t) = (0.039904) \exp(-0.0025)$

$K_t(t) = 1.008/hr^2$

Solution of $K_{x,y}(x, y)$

Table10. Motion and displacement Traffic count of ELWA-Hospital Junction

Time (second)	**Speed (m/sec)**	**X (meter)**	**Acceleration (m/sec2)**	**Y = X + Vt**
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{100^2}{2(200)^2}\right) \exp(-\frac{200^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904) \exp(-0.125) \exp(-2)$

$K_{x,y}(x, y) = 1.49579 exp(-2)$

$\boxed{K_{x,y}(x, y) = 0.44694/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.44694/sec^4 [\frac{100}{10}, \frac{200}{10}] 1.008/hr^2 (\frac{10}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5} \sum_{i=1}^{6} 0.44694/sec^4 [(10), (20)], 1.008/hr^2 \frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 11**.** One-hour Arithmetic Traffic count of ELWA-Harbel Junction

Eternal Love Winning All –Harbel Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	170	0.620438	62.0438		1.611765
SB	50	0.182482	18.24818		5.48
LB	19	6.934307	6.934307		14.42105
ST	18	0.065693	6.569343		15.22222
MST	11	0.040146	4.014599		24.90909
LT	6	0.021898	2.189781		45.66667
		1	100	100	
TOTAL	274				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ \ (1.611)^{1hr}(100)(1.611)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 62.043(1.611)^{1hr}(1.611)}$$

$$I = \frac{6\ \ (1.611)^{1hr}(100)(1.611)}{(6)(6)62.043(1.611)^{1hr}(1.611)}$$

$$I = \frac{(100)}{(6)(62.043)}$$

$$I = 0.269$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998} \exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904) \exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x,y)$

Table 12. Motion and displacement Traffic count of ELWA-Harbel Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904) \exp\left(-\frac{100^2}{2(200)^2}\right) \exp(-\frac{200^2}{2(200)^2})$$

$$K_{x,y}(x,y) = (0.039904) \exp(-0.125) \exp(-2)$$

$$K_{x,y}(x,y) = 1.49579 exp(-2)$$

$$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$$

$\hat{F}(x,y,t) = \frac{1}{nh_x h_y h_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.44694/sec^4 [\frac{100}{10}, \frac{200}{10}] 1.008/hr^2 (\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.44694/sec^4[(10),(20)],1.008/hr^2 \frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 13. One-hour Arithmetic Traffic count of Duport Road Junction

Duport Road Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	876	0.87251	87.250996		1.1461187
SB	65	0.064741	6.4741036		15.446154
LB	28	0.0278884	2.7888446		35.857143
ST	12	0.0119522	1.1952191		83.666667
MST	15	0.0149402	1.4940239		66.933333
LT	8	0.0079681	0.7968127		125.5
		1	100	100	
TOTAL	1004				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\ \sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ \ (1.146)^{1hr}(100)(1.146)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(87.251)(1.146)^{1hr}(1.146)}$$

$$I = \frac{6\ \ (1.146)^{1hr}(100)(1.146)}{(6)(6)(87.251)(1.146)^{1hr}(1.146)}$$

$$I = \frac{(100)}{(6)(87.251)}$$

$I = 0.191$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998} \exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904) \exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x, y)$

Table 14. Motion and displacement Traffic count of Duport Road Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{100^2}{2(200)^2}\right) \exp(-\frac{200^2}{2(200)^2})$$

$$K_{x,y}(x, y) = (0.039904) \exp(-0.125) \exp(-2)$$

$$K_{x,y}(x, y) = 1.49579 exp(-2)$$

$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.44694/sec^4[\frac{100}{10}, \frac{200}{10}]1.008/hr^2(\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.44694/sec^4[(10),(20)],1.008/hr^2\,\frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 15. One-hour Arithmetic Traffic count of Nizohn Junction

Nizohn Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	974	0.922348	92.23485		1.084189
SB	22	0.020833	2.083333		48
LB	15	0.014205	1.420455		70.4
ST	18	0.017045	1.704545		58.66667
MST	8	0.007576	0.757576		132
LT	19	0.017992	1.799242		55.57895
		1	100	100	
TOTAL	1056				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6 \ (1.086)^{1hr}(100)(1.086)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 92.033 \ \ (1.086)^{1hr}(1.086)}$$

$$I = \frac{6 \ (1.084)^{1hr}(100)(1.084)}{(6)(6)(92.235)(1.084)^{1hr}(1.084)}$$

$$I = \frac{(100)}{(6)(92.235)}$$

$$I = 0.181$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998} \exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904) \exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x, y)$

Table 16. Motion and displacement Traffic count of Nizohn Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{100^2}{2(200)^2}\right) \exp(-\frac{200^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904)\exp(-0.125)\exp(-2)$

$K_{x,y}(x,y) = 1.49579 exp(-2)$

$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.44694/sec^4[\frac{100}{10}, \frac{200}{10}]1.008/hr^2(\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.44694/sec^4[(10),(20)], 1.008/hr^2 \frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 17. One-hour Arithmetic Traffic count of Gardnerville Junction

Gardnerville Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	730	0.880579	88.0579		1.135616
SB	45	0.054282	5.428227		18.42222
LB	22	0.026538	2.6538		37.68182
ST	6	0.007238	0.723764		138.1667
MST	14	0.016888	1.688782		59.21429
LT	12	0.014475	1.447527		69.08333
		1	100	100	
TOTAL	829				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i-y)(y_j-y)}{\sum_{i=1}^{n}(y_i-y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ \ (1.137)^{1hr}(100)(1.137)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 88.058(1.137)^{1hr}(1.137)}$$

$$I = \frac{6\ \ (1.137)^{1hr}(100)(1.137)}{(6)(6)88.058(1.137)^{1hr}(1.137)}$$

$$I = \frac{(100)}{(6)(88.058)}$$

$$I = 0.189$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998}\exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904)\exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x,y)$

Table 18. Motion and displacement Traffic count of Gardnerville Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}}\exp\left(-\frac{1x_i^2}{2\sigma^2}\right)\exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904)\exp\left(-\frac{100^2}{2(200)^2}\right)\exp(-\frac{200^2}{2(200)^2})$$

$$K_{x,y}(x,y) = (0.039904)\exp(-0.125)\exp(-2)$$

$K_{x,y}(x,y) = 1.49579exp(-2)$

$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x},\frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.44694/sec^4[\frac{100}{10},\frac{200}{10}]1.008/hr^2(\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.44694/sec^4[(10),(20)],1.008/hr^2\frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 19. One-hour Arithmetic Traffic count of Barnesville Junction

Barnesville Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	1220	0.8815029	88.150289		1.1344262
SB	60	0.0433526	4.3352601		23.066667
LB	60	0.0433526	4.3352601		23.066667
ST	24	0.017341	1.734104		57.666667
MST	9	0.0065029	0.650289		153.77778
LT	11	0.007948	0.7947977		125.81818
		1	100	100	
TOTAL		1384			

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i-y)(y_j-y)}{\sum_{i=1}^{n}(y_i-y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ \ (1.134)^{1hr}(100)(1.134)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 88.150(1.134)^{1hr}(1.134)}$$

$$I = \frac{6\ \ (1.134)^{1hr}(100)(1.134)}{(6)(6)88.150(1.134)^{1hr}(1.134)}$$

$$I = \frac{(100)}{(6)(88.150)}$$

$$I = 0.189$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998}\exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904)\exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x, y)$

Table 20. the Motion and displacement Traffic count of Barnesville Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}}\exp\left(-\frac{1x_i^2}{2\sigma^2}\right)\exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904)\exp\left(-\frac{100^2}{2(200)^2}\right)\exp(-\frac{200^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904)\exp(-0.125)\exp(-2)$

$K_{x,y}(x,y) = 1.49579exp(-2)$

$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x},\frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.44694/sec^4[\frac{100}{10},\frac{200}{10}]1.008/hr^2(\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.44694/sec^4[(10),(20)],1.008/hr^2\,\frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 21. One-hour Arithmetic Traffic count of SDA Junction

Seven Day Advantage (SDA) Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	230	0.608466	60.84656		1.643478
SB	75	0.198413	19.84127		5.04
LB	30	0.079365	7.936508		12.6
ST	23	0.060847	6.084656		16.43478
MST	9	0.02381	2.380952		42
LT	11	0.029101	2.910053		34.36364
		1	100	100	
TOTAL	378				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \;\; \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n \; y^T w y}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \;\; y^T y}$$

$$I = \frac{n \; y^T w y}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \;\; y^T y}$$

$$I = \frac{6 \;\; (1.643)^{1hr}(100)(1.643)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 60.847(1.643)^{1hr}(1.643)}$$

$$I = \frac{6 \;\; (1.643)^{1hr}(100)(1.643)}{(6)(6)60.847(1.643)^{1hr}(1.643)}$$

$$I = \frac{(100)}{(6)(60.847)}$$

$$I = 0.274$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998} \exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904) \exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x, y)$

Table 22. Motion and displacement Traffic count of SDA Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904)\exp\left(-\frac{100^2}{2(200)^2}\right)\exp(-\frac{200^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904)\exp(-0.125)\exp(-2)$

$K_{x,y}(x,y) = 1.49579 exp(-2)$

$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.44694/sec^4[\frac{100}{10}, \frac{200}{10}]1.008/hr^2(\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.44694/sec^4[(10),(20)],1.008/hr^2\,\frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 23. One-hour Arithmetic Traffic count of SKD Boulevard Junction

Samuel Kanyan Doe (SKD) Boulevard Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	1130	0.986038	98.60384		1.014159
SB	4	0.00349	0.34904		286.5
LB	3	0.002618	0.002618		382
ST	2	0.001745	0.17452		573
MST	4	0.00349	0.34904		286.5
LT	3	0.002618	0.26178		382
		1	100	100	
TOTAL	1146				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij}} = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.014)^{1hr}(100)(1.014)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(98.604)(1.014)^{1hr}(1.014)}$$

$$I = \frac{6 \ (1.014)^{1hr}(100)(1.014)}{(6)(6)(98.604)(1.014)^{1hr}(1.014)}$$

$$I = \frac{(100)}{(6)(98.604)}$$

$$I = 0.169$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998} \exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904) \exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x, y)$

Table 24**.** Motion and displacement Traffic count of SKD Boulevard

Time (second)	**Speed (m/sec)**	**X (meter)**	**Acceleration (m/sec2)**	**Y = X + Vt**
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904)\exp\left(-\frac{100^2}{2(200)^2}\right)\exp(-\frac{200^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904)\exp(-0.125)\exp(-2)$

$K_{x,y}(x,y) = 1.49579 exp(-2)$

$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.44694/sec^4[\frac{100}{10}, \frac{200}{10}]1.008/hr^2(\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.44694/sec^4[(10),(20)],1.008/hr^2\,\frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 25. One-hour Arithmetic Traffic count of Universit of Liberia-Executive Mansion Junction

University of Liberia -Executive Mansion Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	1245	0.8956835	89.568345		1.1164659
SB	90	0.0647482	6.4748201		15.444444
LB	40	0.028777	2.8776978		34.75
ST	12	34.75	0.8633094		115.83333
MST	1	0.0007194	0.0719424		1390
LT	2	0.0014388	0.1438849		695
		1	100	100	
TOTAL	1390				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \;\; \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n \; y^T w y}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \;\; y^T y}$$

$$I = \frac{n \; y^T w y}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \;\; y^T y}$$

$$I = \frac{6 \; (1.116)^{1hr}(100)(1.116)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 89.568(1.116)^{1hr}(1.116)}$$

$$I = \frac{6 \; (1.116)^{1hr}(100)(1.116)}{(6)(6)89.568(1.116)^{1hr}(1.116)}$$

$$I = \frac{(100)}{(6)(89.568)}$$

$$I = 0.186$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998} \exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904) \exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x, y)$

Table 26. Motion and displacement Traffic count of the University of Liberia-Executive Mansion Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904)\exp\left(-\frac{100^2}{2(200)^2}\right)\exp(-\frac{200^2}{2(200)^2})$$

$$K_{x,y}(x,y) = (0.039904)\exp(-0.125)\exp(-2)$$

$$K_{x,y}(x,y) = 1.49579exp(-2)$$

$$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.44694/sec^4[\frac{100}{10}, \frac{200}{10}]1.008/hr^2(\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.44694/sec^4[(10),(20)], 1.008/hr^2\,\frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 27. One-hour Arithmetic Traffic count SD Cooper Junction

South Detuwal Cooper Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	750	0.880282	88.02817		1.136
SB	70	0.08216	8.215962		12.17143
LB	17	0.019953	1.995305		50.11765
ST	7	0.008216	0.821596		121.7143
MST	6	0.007042	0.704225		142
LT	2	0.002347	0.234742		426
		1	100	100	
TOTAL	852				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i-y)(y_j-y)}{\sum_{i=1}^{n}(y_i-y)^2 \quad \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ (1.136)^{1hr}(100)(1.136)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 88.028\ (1.136)^{1hr}(1.136)}$$

$$I = \frac{6\ (1.136)^{1hr}(100)(1.136)}{(6)(6)88.028\ (1.136)^{1hr}(1.136)}$$

$$I = \frac{(100)}{(6)(88.028)}$$

$$I = 0.189$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998}\exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904)\exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x,y)$

Table 28. Motion and displacement Traffic count of S D Cooper Road

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}}\exp\left(-\frac{1x_i^2}{2\sigma^2}\right)\exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904)\exp\left(-\frac{100^2}{2(200)^2}\right)\exp(-\frac{200^2}{2(200)^2})$$

$$K_{x,y}(x,y) = (0.039904)\exp(-0.125)\exp(-2)$$

$$K_{x,y}(x,y) = 1.49579 exp(-2)$$

$$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x},\frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.44694/sec^4[\frac{100}{10},\frac{200}{10}]1.008/hr^2(\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.44694/sec^4[(10),(20)],1.008/hr^2\,\frac{12960000sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 29. One-hour Arithmetic Traffic count of President Bye Pass Junction

President Bye Pass Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	180	0.612245	61.22449		1.633333
SB	80	0.272109	27.21088		3.675
LB	9	0.030612	3.061224		32.66667
ST	11	0.037415	3.741497		26.72727
MST	9	0.030612	3.061224		32.66667
LT	5	0.017007	1.70068		58.8
		1	100	100	
TOTAL	294				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \;\; \sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij}} = \frac{n \;\; y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij} \;\; y^T y}$$

$$I = \frac{n \;\; y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij} \;\; y^T y}$$

$$I = \frac{6 \;\; (1.633)^{1hr}(100)(1.633)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 61.224 \; (1.633)^{1hr}(1.633)}$$

$$I = \frac{6 \;\; (1.633)^{1hr}(100)(1.633)}{(6)(6)61.224 \; (1.633)^{1hr}(1.633)}$$

$$I = \frac{(100)}{(6)(61.224)}$$

$$I = 0.272$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 1hr, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(t) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(1hr)^2}{2(200)})$$

$$K_t(t) = \frac{1}{25.05998} \exp(-\frac{1hr^2}{400})$$

$$K_t(t) = (0.039904) \exp(-0.0025)$$

$$K_t(t) = 1.008/hr^2$$

Solution of $K_{x,y}(x, y)$

Table 30**.** Motion and displacement Traffic count of President Bye Pass

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
10	10	100	1	200
20	10	200	0.5	400
30	10	300	0.3333333	600
40	10	400	0.25	800
50	10	500	0.2	1000
60	10	600	0.1666667	1200

$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904) \exp\left(-\frac{100^2}{2(200)^2}\right) \exp(-\frac{200^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904) \exp(-0.125) \exp(-2)$

$K_{x,y}(x,y) = 1.49579 exp(-2)$

$\boxed{K_{x,y}(x,y) = 0.44694/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.44694/sec^4[\frac{100}{10}, \frac{200}{10}] 1.008/hr^2(\frac{10}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5} \sum_{i=1}^{6} 0.44694/sec^4[(10), (20)], 1.008/hr^2 \frac{12960000 sec^2}{hr^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5} \sum_{i=1}^{6} 4.4694, 8.9388,\ 7.72X10^{-8}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 4.4694, 8.9388, 7.72X10^{-8})$$

$$\hat{F}(x,y,t) = (\ 0.001787, 0.003575, 5.146X10^{-12}\ )$$

Table 31**.** One-hour Values of Moran (I) and kernel { k(t), K(x,y), and Trend Surface F(x,y,t)]

Name	I	K(t)	K(x,y)	F(x,y,t)
Voice of America (VOA) Junction Direction	0.181	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Rehab Junction Direction	0.195	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Thinker Village Junction Direction	0.231	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
President Church Junction Direction	0.230	1.008	0.44694	0.0001787 0.003575 0.0000000000005146

Eternal Love Winning All (ELWA) Hospital Junction Direction	0.175	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Eternal Love Winning All (ELWA) - Harbel Junction Direction	0.269	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Duport Road Junction Direction	0.191	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Nizohn Junction Direction	0.181	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Gardnerville Junction Direction	0.189	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Barnesville Junction Direction	0.189	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Seven Day Advantage (SDA) Junction Direction	0.274	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
Samuel Kanyan Doe (SKD) Boulevard Junction	0.169	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
University of Liberia-Executive Mansion Direction	0.186	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
South Detuwal Cooper Junction Direction	0.189	1.008	0.44694	0.0001787 0.003575 0.0000000000005146
President Bye Pass Junction Direction	0.271	1.008	0.44694	0.0001787 0.003575 0.0000000000005146

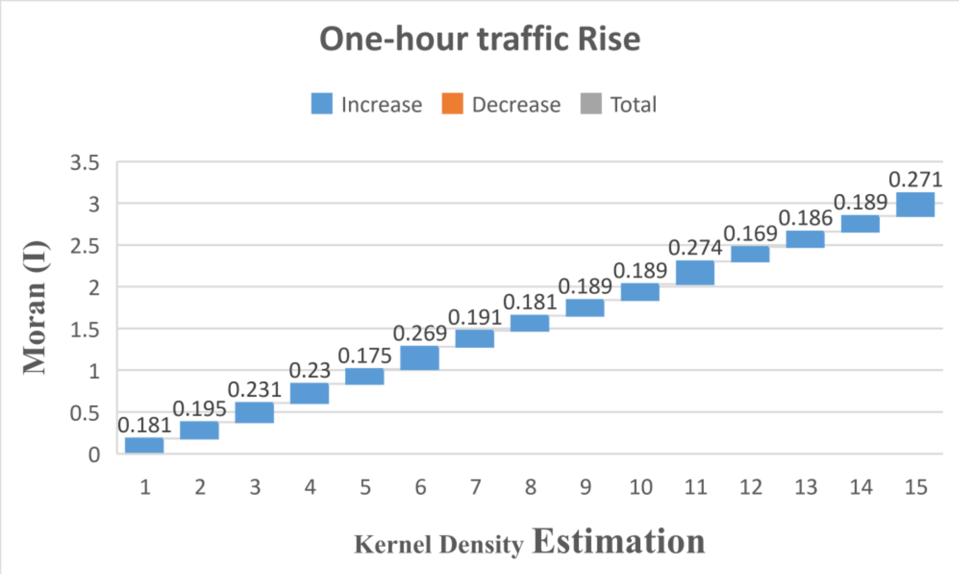


Fig.1. Rise in traffic for one hour

APPENDIX 2

CALCULATION ANALYSIS OF EIGHT-HOURS TRAFFIC COUNT STATISTICS

Table 32**.** Eight-hours Arithmetic Traffic count of VOA Junction

Voice of Africa Junction direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	5998	0.949051	94.90506		1.053685
SB	80	0.012658	1.265823		79
LB	66	0.010443	1.044304		95.75758
ST	75	0.011867	1.186709		84.26667
MST	45	0.00712	0.712025		140.4444
LT	56	0.008861	0.886076		112.8571
		1	100	100	
TOTAL	6320				

T & PC= Taxi and Private Car, **W=** Weight, **W%=**Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n \ y^T w y}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T w y}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.054)^{8hr}(100)(1.054)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 94.905 \ (1.054)^{8hr}(1.054)}$$

$$I = \frac{6 \ (1.054)^{8hr}(100)(1.054)}{(6)(6)94.905 \ (1.054)^{8hr}(1.054)}$$

$$I = \frac{(100)}{(6)(94.905)}$$

$$I = 0.177$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 8hrs, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(8hrs)^2}{2(200)})$$

$$K_t(8) = \frac{1}{25.05998} \exp(-\frac{64hrs^2}{400})$$

$$K_t(8) = (0.039904)\exp(-0.16hrs^2)$$

$$K_t(8) = 1.674/hrs^2$$

Solution of $K_{x,y}(x, y)$

Table 33. Motion and displacement Traffic count of VOA at Eight-hours

Time (second)	**Speed (m/sec)**	**X (meter)**	**Acceleration (m/sec2)**	**Y = X + Vt**
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904)\exp\left(-\frac{300^2}{2(200)^2}\right) \exp(-\frac{330^2}{2(200)^2})$$

$$K_{x,y}(x, y) = (0.039904)\exp(-1.125)\exp(-1.361)$$

$$K_{x,y}(x, y) = 37.485exp(-1.361)$$

$$\boxed{K_{x,y}(x, y) = 0.00808/sec^4}$$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10}, \frac{330}{10}]1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5} \sum_{i=1}^{6} 0.00808/sec^4[(30), (33)], (3)1.674/hr^2 \frac{12960000sec^4}{hr^2}$$

$\hat{F}(x,y,t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664,\ (3)1.2916X10^{-7}$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x,y,t) = (9.695X10^{-5}\ ,1.066X10^{-4}, 1.5498X10^{-10}\ )$$

Table 34. Eight-hours Arithmetic Traffic count of Rehab Junction

Rehab Junction direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	5578	0.853688	85.36884		1.171388
SB	287	0.043924	4.392409		22.76655
LB	137	0.020967	2.096725		47.69343
ST	200	0.030609	3.060912		32.67
MST	256	0.03918	3.917968		25.52344
LT	76	0.011631	1.163147		85.97368
		1	100	100	
TOTAL	6534				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n} \sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \ \sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ \ (1.171)^{8hr}(100)(1.171)}{\sum_{i=1}^{6} \sum_{i=1}^{6} 85.369\ (1.171)^{8hr}(1.171)}$$

$$I = \frac{6\ \ (1.171)^{8hr}(100)(1.171)}{(6)(6)85.369\ (1.171)^{8hr}(1.171)}$$

$$I = \frac{(100)}{(6)(85.369)}$$

$$I = \ 0.195$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 8hrs, \pi = 3.14, \sigma = 200$

$K_t(8) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$

$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(8hrs)^2}{2(200)})$

$K_t(8) = \frac{1}{25.05998} \exp(-\frac{64hrs^2}{400})$

$K_t(8) = (0.039904) \exp(-0.16hrs^2)$

$K_t(8) = 1.674/hrs^2$

Solution of $K_{x,y}(x, y)$

Table 35**.** Motion and displacement Traffic count of Rehab Junction

Time (second)	**Speed (m/sec)**	**X (meter)**	**Acceleration (m/sec2)**	**Y = X + Vt**
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{300^2}{2(200)^2}\right) \exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904) \exp(-1.125) \exp(-1.361)$

$K_{x,y}(x, y) = 37.485 exp(-1.361)$

$\boxed{K_{x,y}(x, y) = 0.00808/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_x h_y h_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.00808/sec^4 [\frac{300}{10}, \frac{330}{10}] 1.674/hr^2 (\frac{30}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5} \sum_{i=1}^{6} 0.00808/sec^4 [(30), (33)], (3) 1.674/hr^2 \frac{12960000 sec^4}{hr^2}$$

$\hat{F}(x, y, t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664,\ (3) 1.2916X10^{-7}$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x,y,t) = (9.695X10^{-5}\ ,1.066X10^{-4}, 1.5498X10^{-10}\ )$$

Table 36**.** Eight-hours Arithmetic Traffic count of Thinker Village Junction

Thinker Village Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	6645	0.769275	76.92753		1.299925
SB	599	0.069345	6.934476		14.4207
LB	902	0.104422	10.44223		9.576497
ST	278	0.032183	3.218338		31.07194
MST	111	0.01285	1.28502		77.81982
LT	103	0.011924	1.192406		83.86408
		1	100	100	
TOTAL	8638				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\ \sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ \ (1.299)^{8hr}(100)(1.299)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 76.928(1.299)^{8hr}(1.299)}$$

$$I = \frac{6\ \ (1.299)^{8hr}(100)(1.299)}{(6)(6)76.928(1.299)^{8hr}(1.299)}$$

$$I = \frac{(100)}{(6)(76.928)}$$

$$I = 0.217$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 8hrs, \pi = 3.14, \sigma = 200$

$$K_t(8) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{(8hrs)^2}{2(200)})$$

$K_t(8) = \frac{1}{25.05998}\exp(-\frac{64hrs^2}{400})$

$K_t(8) = (0.039904)\exp(-0.16hrs^2)$

$K_t(8) = 1.674/hrs^2$

Solution of $K_{x,y}(x, y)$

Table 37**.** Motion and displacement Traffic count of Thinker Village Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}}\exp\left(-\frac{1x_i^2}{2\sigma^2}\right)\exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904)\exp\left(-\frac{300^2}{2(200)^2}\right)\exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904)\exp(-1.125)\exp(-1.361)$

$K_{x,y}(x, y) = 37.485exp(-1.361)$

$\boxed{K_{x,y}(x, y) = 0.00808/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10}, \frac{330}{10}]1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5}\sum_{i=1}^{6} 0.00808/sec^4[(30), (33)], (3)1.674/hr^2\,\frac{12960000sec^4}{hr^2}$$

$\hat{F}(x, y, t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)1.2916X10^{-7}$

$$\hat{F}(x, y, t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x, y, t) = (9.695X10^{-5}\ , 1.066X10^{-4}, 1.5498X10^{-10}\ )$$

Table 38. Eight-hours Arithmetic Traffic count of President Church Junction

President Church Junction Direction					
Vehicles Name	Amount of Vehicle Passages	W	W%	AW%	Y
T & PC	6578	0.739184	73.91842		1.352843
SB	1588	0.178447	17.8447		5.603904
LB	88	0.009889	0.988875		101.125
ST	345	0.038768	3.87684		25.7942
MST	256	0.028767	2.876728		34.76172
LT	44	0.004944	0.494438		202.25
		1	100	100	
TOTAL	8899				

T & PC= Taxi and Private Car, **W=** Weight, **W%**=Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \;\; \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ (1.352)^{8hr}(100)(1.352)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 73.918\ (1.352)^{8hr}(1.352)}$$

$$I = \frac{6\ (1.352)^{8hr}(100)(1.352)}{(6)(6)(73.918)\ (1.352)^{8hr}(1.352)}$$

$$I = \frac{(100)}{(6)(73.918)}$$

$$I = 0.225$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 8hrs, \pi = 3.14, \sigma = 200$

$$K_t(8) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1t_i^2}{2\sigma}\right)$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}} \exp\left(-\frac{(8hrs)^2}{2(200)}\right)$$

$$K_t(8) = \frac{1}{25.05998} \exp\left(-\frac{64hrs^2}{400}\right)$$

$$K_t(8) = (0.039904)\exp(-0.16hrs^2)$$

$K_t(8) = 1.674/hrs^2$

Solution of $K_{x,y}(x, y)$

Table 39. Motion and displacement Traffic count of President Church

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{300^2}{2(200)^2}\right) \exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904) \exp(-1.125) \exp(-1.361)$

$K_{x,y}(x, y) = 37.485 exp(-1.361)$

$\boxed{K_{x,y}(x, y) = 0.00808/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10}, \frac{330}{10}] 1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5} \sum_{i=1}^{6} 0.00808/sec^4[(30), (33)], (3)1.674/hr^2 \frac{12960000sec^4}{hr^2}$$

$\hat{F}(x, y, t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664,\ (3)1.2916X10^{-7}$

$$\hat{F}(x, y, t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x, y, t) = (9.695X10^{-5}\ , 1.066X10^{-4}, 1.5498X10^{-10}\ )$$

Table 40. Eight-hours Arithmetic Traffic count of ELWA-Hospital Junction

Eternal Love Winning All-Hospital					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	5634	0.970208	97.02084		1.030706
SB	43	0.007405	0.740486		135.0465
LB	37	0.006372	0.637162		156.9459
ST	28	0.004822	0.482177		207.3929
MST	27	0.00465	0.464956		215.0741
LT	38	0.006544	0.654383		152.8158
		1	100	100	
TOTAL	5807				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.031)^{8hr}(100)(1.031)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 97.021 \ (1.031)^{8hr}(1.031)}$$

$$I = \frac{6 \ (1.031)^{8hr}(100)(1.031)}{(6)(6)(97.021) \ (1.031)^{8hr}(1.031))}$$

$$I = \frac{(100)}{(6)(97.021)}$$

$$I = 0.172$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 8hrs, \pi = 3.14, \sigma = 200$

$$K_t(8) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{(8hrs)^2}{2(200)})$$

$K_t(8) = \frac{1}{25.05998}\exp(-\frac{64hrs^2}{400})$

$K_t(8) = (0.039904)\exp(-0.16hrs^2)$

$K_t(8) = 1.674/hrs^2$

Solution of $K_{x,y}(x, y)$

Table 41. Motion and displacement Traffic count of ELWA-Hospital Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}}\exp\left(-\frac{1x_i^2}{2\sigma^2}\right)\exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904)\exp\left(-\frac{300^2}{2(200)^2}\right)\exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904)\exp(-1.125)\exp(-1.361)$

$K_{x,y}(x, y) = 37.485exp(-1.361)$

$\boxed{K_{x,y}(x, y) = 0.00808/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10}, \frac{330}{10}]1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5}\sum_{i=1}^{6} 0.00808/sec^4[(30), (33)], (3)1.674/hr^2\,\frac{12960000sec^4}{hr^2}$$

$\hat{F}(x, y, t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)1.2916X10^{-7}$

$$\hat{F}(x, y, t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x, y, t) = (9.695X10^{-5}\ ,1.066X10^{-4}, 1.5498X10^{-10}\ )$$

Table 42. Eight-hours Arithmetic Traffic count of ELWA-Harbel Junction

External Love Winning All - Harbel					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	1345	0.654183	65.41829		1.528625
SB	330	0.160506	16.05058		6.230303
LB	134	0.065175	6.51751		15.34328
ST	134	0.065175	6.51751		15.34328
MST	70	0.034047	3.404669		29.37143
LT	43	0.020914	2.09144		47.81395
		1	100	100	
TOTAL	2056				

T & PC= Taxi and Private Car, **W=** Weight, **W%=**Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ \ (1.529)^{8hr}(100)(1.529)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 65.418\ (1.529)^{8hr}(1.529)}$$

$$I = \frac{6\ \ (1.529)^{8hr}(100)(1.529)}{(6)(6)(65.418)\ (1.529)^{8hr}(1.529)}$$

$$I = \frac{(100)}{(6)(65.418)}$$

$$I = 0.255$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 8hrs, \pi = 3.14, \sigma = 200$

$$K_t(8) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{(8hrs)^2}{2(200)})$$

$$K_t(8) = \frac{1}{25.05998}\exp(-\frac{64hrs^2}{400})$$

$K_t(8) = (0.039904)\exp(-0.16hrs^2)$

$K_t(8) = 1.674/hrs^2$

Solution of $K_{x,y}(x,y)$

Table 43. Motion and displacement Traffic count of ELWA-Harbel Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}}\exp\left(-\frac{1x_i^2}{2\sigma^2}\right)\exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904)\exp\left(-\frac{300^2}{2(200)^2}\right)\exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904)\exp(-1.125)\exp(-1.361)$

$K_{x,y}(x,y) = 37.485exp(-1.361)$

$\boxed{K_{x,y}(x,y) = 0.00808/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x},\frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10},\frac{330}{10}]1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 0.00808/sec^4[(30),(33)],(3)1.674/hr^2\,\frac{12960000sec^4}{hr^2}$$

$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)1.2916X10^{-7}$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x,y,t) = (9.695X10^{-5}\ ,1.066X10^{-4}, 1.5498X10^{-10}\ )$$

Table 44. Eight-hours Arithmetic Traffic count of Duport Road Junction

Duport Road Junction Direction					
Vehicles Name	Amount of Vehicle Passages	W	W%	AW%	Y
T & PC	6998	0.891579	89.15785		1.121606
SB	476	0.060645	6.064467		16.4895
LB	189	0.02408	2.40795		41.5291
ST	45	0.005733	0.573321		174.4222
MST	87	0.011084	1.108421		90.21839
LT	54	0.00688	0.687986		145.3519
		1	100	100	
TOTAL	7849				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.122)^{8hr}(100)(1.122)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 89.158 \ (1.122)^{8hr}(1.122)}$$

$$I = \frac{6 \ (1.122)^{8hr}(100)(1.122)}{(6)(6)(89.158 \ (1.122)^{8hr}(1.122)}$$

$$I = \frac{(100)}{(6)(89.158)}$$

$$I = \ 0.187$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 8hrs, \pi = 3.14, \sigma = 200$

$$K_t(8) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{(8hrs)^2}{2(200)})$$

$K_t(8) = \frac{1}{25.05998} \exp(-\frac{64hrs^2}{400})$

$K_t(8) = (0.039904) \exp(-0.16hrs^2)$

$K_t(8) = 1.674/hrs^2$

Solution of $K_{x,y}(x, y)$

Table 45. Motion and displacement Traffic count of Duport Road Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{300^2}{2(200)^2}\right) \exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904) \exp(-1.125) \exp(-1.361)$

$K_{x,y}(x, y) = 37.485exp(-1.361)$

$\boxed{K_{x,y}(x, y) = 0.00808/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10}, \frac{330}{10}] 1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5} \sum_{i=1}^{6} 0.00808/sec^4[(30), (33)], (3)1.674/hr^2 \frac{12960000sec^4}{hr^2}$$

$\hat{F}(x, y, t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664, (3)1.2916X10^{-7}$

$$\hat{F}(x, y, t) = 6.666X10^{-5}(6)(0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x, y, t) = (9.695X10^{-5}, 1.066X10^{-4}, 1.5498X10^{-10})$$

Table 46. Eight-hours Arithmetic Traffic count of Nizohn Junction

Nizohn Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	7765	0.947413	94.74134		1.055505
SB	167	0.020376	2.037579		49.07784
LB	98	0.011957	1.195705		83.63265
ST	87	0.010615	1.061493		94.2069
MST	34	0.004148	0.414837		241.0588
LT	45	0.00549	0.549048		182.1333
		1	100	100	
TOTAL	8196				

T & PC= Taxi and Private Car, **W=** Weight, **W%**=Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n \ y^T w y}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T w y}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.056)^{8hr}(100)(1.056)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 94.741 \ (1.086)^{8hr}(1.086)}$$

$$I = \frac{6 \ (1.056)^{8hr}(100)(1.056)}{(6)(6)(94.741) \ (1.086)^{8hr}(1.086)}$$

$$I = \frac{(100)}{(6)(94.741)}$$

$$I = 0.176$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 8hrs, \pi = 3.14, \sigma = 200$

$$K_t(8) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(8hrs)^2}{2(200)})$$

$$K_t(8) = \frac{1}{25.05998} \exp(-\frac{64hrs^2}{400})$$

$K_t(8) = (0.039904)\exp(-0.16hrs^2)$

$K_t(8) = 1.674/hrs^2$

Solution of $K_{x,y}(x, y)$

Table 47. Motion and displacement Traffic count of Nizohn Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}}\exp\left(-\frac{1x_i^2}{2\sigma^2}\right)\exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904)\exp\left(-\frac{300^2}{2(200)^2}\right)\exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904)\exp(-1.125)\exp(-1.361)$

$K_{x,y}(x, y) = 37.485exp(-1.361)$

$\boxed{K_{x,y}(x, y) = 0.00808/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10}, \frac{330}{10}]1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5}\sum_{i=1}^{6} 0.00808/sec^4[(30), (33)], (3)1.674/hr^2\,\frac{12960000sec^4}{hr^2}$$

$\hat{F}(x, y, t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)1.2916X10^{-7}$

$$\hat{F}(x, y, t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x, y, t) = (9.695X10^{-5}\ ,1.066X10^{-4}, 1.5498X10^{-10}\ )$$

Table 48. Eight-hours Arithmetic Traffic count of Gardnerville Junction

Gardnerville Junction Direction

Vehicles Name	Amount of Vehicle Passages	W	W%	AW%	Y
T & PC	5800	0.89825	89.825		1.113276
SB	323	0.050023	5.002323		19.99071
LB	145	0.022456	2.245625		44.53103
ST	32	0.004956	0.495586		201.7813
MST	90	0.013938	1.393836		71.74444
LT	67	0.010376	1.037634		96.37313
		1	100	100	
TOTAL	6457				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \;\; \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ (1.113)^{8hr}(100)(1.113)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 89.825\ (1.113)^{8hr}(1.113)}$$

$$I = \frac{6\ (1.113)^{8hr}(100)(1.113)}{(6)(6)(89.825)\ (1.113)^{8hr}(1.113)}$$

$$I = \frac{(100)}{(6)(89.825)}$$

$$I = 0.186$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 8hrs, \pi = 3.14, \sigma = 200$

$$K_t(8) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{(8hrs)^2}{2(200)})$$

$$K_t(8) = \frac{1}{25.05998}\exp(-\frac{64hrs^2}{400})$$

$$K_t(8) = (0.039904)\exp(-0.16hrs^2)$$

$$K_t(8) = 1.674/hrs^2$$

Solution of $K_{x,y}(x, y)$

Table 49. Motion and displacement Traffic count of Gardnerville Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{300^2}{2(200)^2}\right) \exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904) \exp(-1.125) \exp(-1.361)$

$K_{x,y}(x, y) = 37.485 exp(-1.361)$

$\boxed{K_{x,y}(x, y) = 0.00808/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_x h_y h_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.00808/sec^4 [\frac{300}{10}, \frac{330}{10}] 1.674/hr^2 (\frac{30}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5} \sum_{i=1}^{6} 0.00808/sec^4 [(30), (33)], (3) 1.674/hr^2 \frac{12960000 sec^4}{hr^2}$$

$\hat{F}(x, y, t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664,\ (3)1.2916X10^{-7}$

$$\hat{F}(x, y, t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x, y, t) = (9.695X10^{-5}\ , 1.066X10^{-4}, 1.5498X10^{-10}\ )$$

Table 50. Eight-hours Arithmetic Traffic count of Barnesville Junction

Barnesville Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	9745	0.853701	85.37013		1.17137
SB	435	0.038108	3.810775		26.24138
LB	434	0.03802	3.802015		26.30184
ST	367	0.032151	3.215068		31.10354
MST	256	0.022427	2.242663		44.58984
LT	178	0.015594	1.559352		64.12921
		1	100	100	
TOTAL	11415				

T & PC= Taxi and Private Car, **W=** Weight, **W%**=Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.171)^{8hr}(100)(1.171)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 85.37 \ (1.171)^{8hr}(1.171)}$$

$$I = \frac{6 \ (1.171)^{8hr}(100)(1.171)}{(6)(6)(85.37 \ (1.171)^{8hr}(1.171)}$$

$$I = \frac{(100)}{(6)(85.37)}$$

$$I = 0.195$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 8hrs, \pi = 3.14, \sigma = 200$

$$K_t(8) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(8hrs)^2}{2(200)})$$

$$K_t(8) = \frac{1}{25.05998} \exp(-\frac{64hrs^2}{400})$$

$$K_t(8) = (0.039904)\exp(-0.16hrs^2)$$
$$K_t(8) = 1.674/hrs^2$$

Solution of $K_{x,y}(x, y)$

Table 51**.** Motion and displacement Traffic count of Barnesville Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}}\exp\left(-\frac{1x_i^2}{2\sigma^2}\right)\exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904)\exp\left(-\frac{300^2}{2(200)^2}\right)\exp(-\frac{330^2}{2(200)^2})$$

$$K_{x,y}(x, y) = (0.039904)\exp(-1.125)\exp(-1.361)$$

$$K_{x,y}(x, y) = 37.485exp(-1.361)$$

$$\boxed{K_{x,y}(x, y) = 0.00808/sec^4}$$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10}, \frac{330}{10}]1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5}\sum_{i=1}^{6} 0.00808/sec^4[(30), (33)], (3)1.674/hr^2\,\frac{12960000sec^4}{hr^2}$$

$$\hat{F}(x, y, t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)1.2916X10^{-7}$$

$$\hat{F}(x, y, t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x, y, t) = (9.695X10^{-5}, 1.066X10^{-4}, 1.5498X10^{-10})$$

Table 52**.** Eight-hours Arithmetic Traffic count of SDA Junction

Seven Day Advantage (SDA) Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	1745	0.637792	63.77924		1.567908
SB	548	0.200292	20.02924		4.992701
LB	176	0.064327	6.432749		15.54545
ST	123	0.044956	4.495614		22.2439
MST	56	0.020468	2.046784		48.85714
LT	88	0.032164	3.216374		31.09091
		1	100	100	
TOTAL	2736				

T & PC= Taxi and Private Car, **W=** Weight, **W%**=Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \;\; \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ \ (1.567)^{8hr}(100)(1.567)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(63.779)(1.567)^{8hr}(1.567)}$$

$$I = \frac{6\ \ (1.567)^{8hr}(100)(1.567)}{(6)(6)(63.779)(1.567)^{8hr}(1.567)}$$

$$I = \frac{(100)}{(6)(63.779)}$$

$$I = 0.261$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 8hrs, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{(8hrs)^2}{2(200)})$$

$$K_t(8) = \frac{1}{25.05998}\exp(-\frac{64hrs^2}{400})$$

$$K_t(8) = (0.039904)\exp(-0.16hrs^2)$$

$K_t(8) = 1.674/hrs^2$

Solution of $K_{x,y}(x, y)$

Table 53. Motion and displacement Traffic count of S D A Junction

Time (second)	**Speed (m/sec)**	**X (meter)**	**Acceleration (m/sec2)**	**Y = X + Vt**
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{300^2}{2(200)^2}\right) \exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904) \exp(-1.125) \exp(-1.361)$

$K_{x,y}(x, y) = 37.485 exp(-1.361)$

$\boxed{K_{x,y}(x, y) = 0.00808/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10}, \frac{330}{10}]1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5} \sum_{i=1}^{6} 0.00808/sec^4[(30), (33)], (3)1.674/hr^2 \frac{12960000sec^4}{hr^2}$$

$\hat{F}(x, y, t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664, (3)1.2916X10^{-7}$

$$\hat{F}(x, y, t) = 6.666X10^{-5}(6)(0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x, y, t) = (9.695X10^{-5}, 1.066X10^{-4}, 1.5498X10^{-10})$$

Table 54. Eight-hours Arithmetic Traffic count of SKD Boulevard Junction

Samuel Kanyan Doe (SKD) Boulevard Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	9012	0.996792	99.67924		1.003218
SB	5	0.000553	0.055304		1808.2
LB	4	0.000442	0.044243		2260.25
ST	1	0.000111	0.011061		9041
MST	10	0.001106	0.110607		904.1
LT	9	0.000995	0.099547		1004.556
		1	100	100	
TOTAL	9041				

T & PC= Taxi and Private Car, **W=** Weight, **W%**=Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ (1.003)^{8hr}(100)(1.003)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(99.679)(1.003)^{8hr}(1.003)}$$

$$I = \frac{6\ (1.003)^{8hr}(100)(1.003)}{(6)(6)(99.679)(1.003)^{8hr}(1.003)}$$

$$I = \frac{(100)}{(6)(99.679)}$$

$$I = 0.167$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{(8hrs)^2}{2(200)})$$

$$K_t(8) = \frac{1}{25.05998}\exp(-\frac{64hrs^2}{400})$$

$$K_t(8) = (0.039904)\exp(-0.16hrs^2)$$

$K_t(8) = 1.674/hrs^2$

Solution of $K_{x,y}(x,y)$

Table 55. Motion and displacement Traffic count of S K D Boulevard Junction

Time (second)	**Speed (m/sec)**	**X (meter)**	**Acceleration (m/sec2)**	**Y = X + Vt**
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904) \exp\left(-\frac{300^2}{2(200)^2}\right) \exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904) \exp(-1.125) \exp(-1.361)$

$K_{x,y}(x,y) = 37.485 exp(-1.361)$

$\boxed{K_{x,y}(x,y) = 0.00808/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10}, \frac{330}{10}]1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5} \sum_{i=1}^{6} 0.00808/sec^4[(30),(33)],(3)1.674/hr^2 \frac{12960000 sec^4}{hr^2}$$

$\hat{F}(x,y,t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664,\ (3)1.2916X10^{-7}$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x,y,t) = (9.695X10^{-5}, 1.066X10^{-4}, 1.5498X10^{-10}\ )$$

Table 56. Eight-hours Arithmetic Traffic count of University of Liberia-Executive Mansion Junction

University of Liberia -Executive Mansion Direction

Vehicles Name	Amount of Vehicle Passages	W	W%	AW%	Y
T & PC	9934	0.908127	90.81269		1.101168
SB	675	0.061706	6.170582		16.20593
LB	265	0.024225	2.422525		41.27925
ST	65	0.005942	0.594204		168.2923
		1	100	100	
TOTAL	10939				

T & PC= Taxi and Private Car, **W=** Weight, **W%**=Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \;\; \sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij}} = \frac{n \;\, y^T w y}{\sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij} \;\; y^T y}$$

$$I = \frac{n \;\, y^T w y}{\sum_{i=1}^{n}\sum_{i=1}^{n} \omega_{ij} \;\; y^T y}$$

$$I = \frac{6 \;\, (1.101)^{8hr}(100)(1.101)}{\sum_{i=1}^{6}\sum_{i=1}^{6})(90.813)(1.101)^{8hr}(1.101)}$$

$$I = \frac{6 \;\, (1.101)^{8hr}(100)(1.101)}{(6)(6)(90.813)(1.101)^{8hr}(1.101)}$$

$$I = \frac{(100)}{(6)(90.813)}$$

$$I = 0.184$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{(8hrs)^2}{2(200)})$$

$$K_t(8) = \frac{1}{25.05998} \exp(-\frac{64hrs^2}{400})$$

$$K_t(8) = (0.039904)\exp(-0.16hrs^2)$$

$$K_t(8) = 1.674/hrs^2$$

Solution of $K_{x,y}(x,y)$

Table 57. Motion and displacement Traffic count of the University of Liberia-Executive Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904) \exp\left(-\frac{300^2}{2(200)^2}\right) \exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904) \exp(-1.125) \exp(-1.361)$

$K_{x,y}(x,y) = 37.485 exp(-1.361)$

$\boxed{K_{x,y}(x,y) = 0.00808/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10}, \frac{330}{10}] 1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5} \sum_{i=1}^{6} 0.00808/sec^4[(30), (33)], (3)1.674/hr^2 \frac{12960000sec^4}{hr^2}$$

$\hat{F}(x,y,t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664,\ (3)1.2916X10^{-7}$

$$\hat{F}(x,y,t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x,y,t) = (9.695X10^{-5}, 1.066X10^{-4}, 1.5498X10^{-10}\ )$$

Table 58. Eight-hours Arithmetic Traffic count of S D Cooper Junction

South Detuwal Cooper Junction Direction					
Vehicles Name	Amount of Vehicle Passages	W	W%	AW%	Y
T & PC	6000	0.880282	88.02817		1.136
SB	560	0.08216	8.215962		12.17143
LB	136	0.019953	1.995305		50.11765
ST	56	0.008216	0.821596		121.7143
MST	48	0.007042	0.704225		142
LT	16	0.002347	0.234742		426
		1	100	100	
TOTAL	6816				

T & PC= Taxi and Private Car, **W=** Weight, **W%**=Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \;\; \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ (1.136)^{8hr}(100)(1.136)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(88.028)(1.136)^{8hr}(1.136)}$$

$$I = \frac{6\ (1.136)^{8hr}(100)(1.136)}{(6)(6)(88.028)(1.136)^{8hr}(1.136)}$$

$$I = \frac{(100)}{(6)(88.028)}$$

$$I = 0.189$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{(8hrs)^2}{2(200)})$$

$$K_t(8) = \frac{1}{25.05998}\exp(-\frac{64hrs^2}{400})$$

$$K_t(8) = (0.039904)\exp(-0.16hrs^2)$$

$K_t(8) = 1.674/hrs^2$

Solution of $K_{x,y}(x, y)$

Table 59. Motion and displacement Traffic count of S D Cooper Road Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{300^2}{2(200)^2}\right) \exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904) \exp(-1.125) \exp(-1.361)$

$K_{x,y}(x, y) = 37.485 exp(-1.361)$

$\boxed{K_{x,y}(x, y) = 0.00808/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10}, \frac{330}{10}]1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5} \sum_{i=1}^{6} 0.00808/sec^4[(30), (33)], (3)1.674/hr^2 \frac{12960000sec^4}{hr^2}$$

$\hat{F}(x, y, t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664,\ (3)1.2916X10^{-7}$

$$\hat{F}(x, y, t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x, y, t) = (9.695X10^{-5}, 1.066X10^{-4}, 1.5498X10^{-10})$$

Table 60. Eight-hours Arithmetic Traffic count of President Bye Pass Junction

President Bye Pass Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	1440	0.612245	61.22449		1.633333
SB	640	0.272109	27.21088		3.675
LB	72	0.030612	3.061224		32.66667
ST	88	0.037415	3.741497		26.72727
MST	72	0.030612	3.061224		32.66667
LT	40	0.017007	1.70068		58.8
		1	100	100	
TOTAL	2352				

T & PC= Taxi and Private Car, **W=** Weight, **W%**=Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ \ (1.633)^{8hr}(100)(1.633)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(61.224)(1.633)^{8hr}(1.633)}$$

$$I = \frac{6\ \ (1.633)^{8hr}(100)(1.633)}{(6)(6)(61.224)(1.633)^{8hr}(1.633)}$$

$$I = \frac{(100)}{(6)(61.224)}$$

$$I = 0.272$$

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(8) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{(8hrs)^2}{2(200)})$$

$$K_t(8) = \frac{1}{25.05998}\exp(-\frac{64hrs^2}{400})$$

$$K_t(8) = (0.039904)\exp(-0.16hrs^2)$$

$K_t(8) = 1.674/hrs^2$

Solution of $K_{x,y}(x, y)$

Table 61. Motion and displacement Traffic count of President Bye Pass Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
30	10	300	0.333333	330
60	10	600	0.166667	660
90	10	900	0.111111	990
120	10	1200	0.083333	1320
150	10	1500	0.066667	1650
180	10	1800	0.055556	1980

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{300^2}{2(200)^2}\right) \exp(-\frac{330^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904) \exp(-1.125) \exp(-1.361)$

$K_{x,y}(x, y) = 37.485exp(-1.361)$

$\boxed{K_{x,y}(x, y) = 0.00808/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_x h_y h_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 0.00808/sec^4[\frac{300}{10}, \frac{330}{10}]1.674/hr^2(\frac{30}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5} \sum_{i=1}^{6} 0.00808/sec^4[(30), (33)], (3)1.674/hr^2 \frac{12960000sec^4}{hr^2}$$

$\hat{F}(x, y, t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664,\ (3)1.2916X10^{-7}$

$$\hat{F}(x, y, t) = 6.666X10^{-5}(6)(\ 0.2424, 0.26664, 3.895X10^{-7})$$

$$\hat{F}(x, y, t) = (9.695X10^{-5}, 1.066X10^{-4}, 1.5498X10^{-10})$$

Table 62. Eight-hours Values of Moran (I) and kernel { k(t), K(x,y), and Trend Surface F(x,y,t)}

Name	I	K(t)	K(x,y)	F(x,y,t)

Voice of America (VOA) Junction Direction	0.177	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Rehab Junction Direction	0.195	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Thinker Village Junction Direction	0.217	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
President Church Junction Direction	0.225	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Eternal Love Winning All (ELWA) Hospital Junction Direction	0.172	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Eternal Love Winning All (ELWA) - Harbel Junction Direction	0.225	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Duport Road Junction Direction	0.187	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Nizohn Junction Direction	0.176	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Gardnerville Junction Direction	0.186	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Barnesville Junction Direction	0.195	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
Seven Day Advantage (SDA) Junction Direction	0.261	1.674	0.00808	0.00009695 0.0001066 0.0000000015498

Samuel Kanyan Doe (SKD) Boulevard Junction	0.167	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
University of Liberia-Executive Mansion Direction	0.184	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
South Detuwal Cooper Junction Direction	0.189	1.674	0.00808	0.00009695 0.0001066 0.0000000015498
President Bye Pass Junction Direction	0.270	1.674	0.00808	0.00009695 0.0001066 0.0000000015498

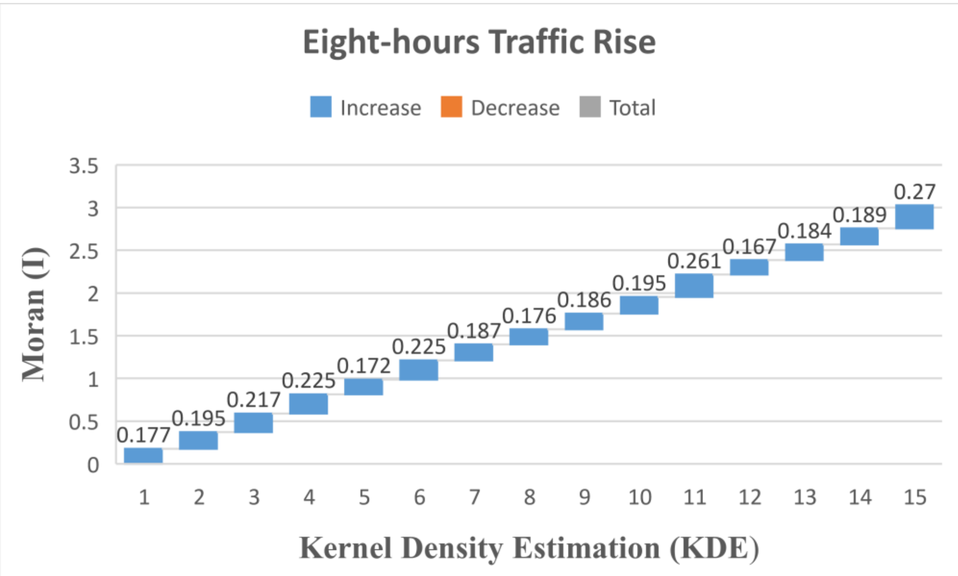


Fig. 2. Rise in traffic for eight hours

APPENDIX 3.

CALCULATION ANALYSIS OF ONE-MONTHTRAFFIC COUNT STATISTICS

Table 63. One-month Arithmetic Traffic count of VOA Junction

Voice of Africa Junction direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	188101	0.739882	73.98822		1.351566
SB	43662	0.171741	17.17414		5.822706
LB	3994	0.01571	1.571012		63.65323
ST	6810	0.026787	2.678666		37.33201
MST	8702	0.034229	3.422871		29.21524
LT	2962	0.011651	1.165082		85.83086
		1	100	100	
TOTAL	254231				

T & PC= Taxi and Private Car, **W=** Weight, **W%**=Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.352)^{30days}(100)(1.352)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(73.988)(1.352)^{30days}(1.352)}$$

$$I = \frac{6 \ (1.352)^{30days}(100)(1.352)}{(6)(6)(73.988)(1.352)^{30days}(1.352)}$$

$$I = \frac{(100)}{(6)(73.988)}$$

$$I = 0.225$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{30^2}{2(200)})$$

$$K_t(30) = \frac{1}{25.05998}\exp(-\frac{900}{400})$$

$$K_t(30) = (0.039904)\exp(-2.25)$$

$$K_t(30) = 1405.098014/days^2$$

Solution of $K_{x,y}(x, y)$

Table 64. Motion and displacement Traffic count of VOA Junction

Time (second)	**Speed (m/sec)**	**X (meter)**	**Acceleration (m/sec2)**	**Y = X + Vt**
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}}\exp\left(-\frac{1x_i^2}{2\sigma^2}\right)\exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904)\exp\left(-\frac{900^2}{2(200)^2}\right)\exp(-\frac{990^2}{2(200)^2})$$

$$K_{x,y}(x, y) = (0.039904)\exp(-10.125)\exp(-12.251)$$

$$K_{x,y}(x, y) = 1.4612X10^{14}exp(-12.251)$$

$$\boxed{K_{x,y}(x, y) = 2.9387X10^{-174}/sec^4}$$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10}, \frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90),(99)],(9)1405.098$$

$$/days^2 \frac{2592000sec^4}{days^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 65. One-month Arithmetic Traffic count of Rehab Junction

Rehab Junction direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	8876	0.334893	33.48928		2.98603
SB	8876	0.579799	57.97993		1.724735
LB	548	0.020676	2.067612		48.36496
ST	613	0.023129	2.312858		43.23654
MST	547	0.020638	2.063839		48.45338
LT	553	0.020865	2.086478		47.92767
		1	100	100	
TOTAL	26504				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i-y)(y_j-y)}{\sum_{i=1}^{n}(y_i-y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{6\ \ (1.725)^{30days}(100)(1.725)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(57.979)(1.725)^{30days}(1.725)}$$

$$I = \frac{6\ \ (1.725)^{30days}(100)(1.725)}{(6)(6)(57.979)(1.725)^{30days}(1.725)}$$

$I = \frac{(100)}{(6)(57.979)}$

$I = 0.287$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$

$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$

$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$

$K_t(30) = (0.039904) \exp(-2.25)$

$K_t(30) = 1405.098014/days^2$

Solution of $K_{x,y}(x,y)$

Table 66. Motion and displacement Traffic count of Rehab Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904) \exp\left(-\frac{900^2}{2(200)^2}\right) \exp(-\frac{990^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904)\exp(-10.125)\exp(-12.251)$

$K_{x,y}(x,y) = 1.4612X10^{14}exp(-12.251)$

$\boxed{K_{x,y}(x,y) = 2.9387X10^{-174}/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x},\frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10},\frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90),(99)],(9)1405.098$$

$$/days^2\,\frac{2592000sec^4}{days^2}$$

$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 67. One-month Arithmetic Traffic count of Thinker Village Junction

Thinker Village Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	250519	0.692156	69.21562		1.444761
SB	250519	0.019249	1.924905		51.95062
LB	66374	0.183384	18.3384		5.453039
ST	31062	0.085821	8.582085		11.65218
MST	6352	0.01755	1.754987		56.98048
LT	666	0.00184	0.184008		543.4535
		1	100	100	
TOTAL	361940				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i-y)(y_j-y)}{\sum_{i=1}^{n}(y_i-y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{6\ (1.444)^{30days}(100)(1.444)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(69.216)(1.444)^{30days}(1.444)}$$

$$I = \frac{6\ (1.444)^{30days}(100)(1.444)}{(6)(6)(69.216)(1.444)^{30days}(1.444)}$$

$$I = \frac{(100)}{(6)(69.216)}$$

$$I = 0.241$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$$

$$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$$

$$K_t(30) = (0.039904) \exp(-2.25)$$

$$K_t(30) = \frac{1405.098014}{days^2}$$

Solution of $K_{x,y}(x, y)$

Table 68. Motion and displacement Traffic count of Thinker Village Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904)\exp\left(-\frac{900^2}{2(200)^2}\right)\exp(-\frac{990^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904)\exp(-10.125)\exp(-12.251)$

$K_{x,y}(x,y) = 1.4612X10^{14}exp(-12.251)$

$\boxed{K_{x,y}(x,y) = 2.9387X10^{-174}/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x},\frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10},\frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90),(99)],(9)1405.098$$

$$/days^2\frac{2592000sec^4}{days^2}$$

$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 69. One-month Arithmetic Traffic count of President Church Junction

President Church Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	203714	0.760164	76.01637		1.315506
SB	47632	0.17774	17.774		5.626197
LB	1943	0.00725	0.725035		137.9243
ST	7929	0.029587	2.958726		33.79834
MST	7929	0.020635	2.063533		48.46058
LT	1239	0.004623	0.462336		216.293
		1	100	100	
TOTAL	267987				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n} \sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij}} = \frac{n \ y^T wy}{\sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T wy}{\sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.316)^{30days}(100)(1.316)}{\sum_{i=1}^{6} \sum_{i=1}^{6}(76.016)(1.316)^{30days}(1.316)}$$

$$I = \frac{6 \ (1.316)^{30days}(100)(1.316)}{(6)(6)(76.016)(1.316)^{30days}(1.316)}$$

$$I = \frac{(100)}{(6)(76.016)}$$

$$I = 0.219$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$$

$$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$$

$$K_t(30) = (0.039904) \exp(-2.25)$$

$$K_t(30) = 1405.098014/days^2$$

Solution of $K_{x,y}(x, y)$

Table 70. Motion and displacement Traffic count of President Church Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{900^2}{2(200)^2}\right) \exp(-\frac{990^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904) \exp(-10.125) \exp(-12.251)$

$K_{x,y}(x, y) = 1.4612X10^{14} exp(-12.251)$

$\boxed{K_{x,y}(x, y) = 2.9387X10^{-174}/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10}, \frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x, y, t) = 6.666^{-5} \sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90), (99)], (9)1405.098$$

$$/days^2 \frac{2592000sec^4}{days^2}$$

$\hat{F}(x, y, t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664, \ (3)7.72X10^{-8}$

$$\hat{F}(x, y, t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 71. One-month Arithmetic Traffic count of ELWA-Hospital Junction

Eternal Love Winning All –Hospital Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	178039	0.977866	97.78655		1.022635
SB	845	0.004641	0.46411		215.4663
LB	892	0.004899	0.489924		204.1132
ST	683	0.003751	0.375133		266.5725
MST	630	0.00346	0.346023		288.9984
LT	980	0.005383	0.538257		185.7847
		1	100	100	
TOTAL					

T & PC= Taxi and Private Car, **W=** Weight, **W%**=Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.023)^{30days}(100)(1.023)}{\sum_{i=1}^{6}\sum_{i=1}^{6} 97.797 \ (1.023)^{30days}(1.023)}$$

$$I = \frac{6 \ (1.023)^{30days}(100)(1.023)}{(6)(6)(97.797) \ (1.023)^{30days}(1.023)}$$

$$I = \frac{(100)}{(6)(97.797)}$$

$$I = 0.170$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$$

$$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$$

$$K_t(30) = (0.039904) \exp(-2.25)$$

$$K_t(30) = 1405.098014/days^2$$

Solution of $K_{x,y}(x, y)$

Table 72. Motion and displacement Traffic count of ELWA-Hospital Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904) \exp\left(-\frac{900^2}{2(200)^2}\right) \exp(-\frac{990^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904) \exp(-10.125) \exp(-12.251)$

$K_{x,y}(x,y) = 1.4612X10^{14} exp(-12.251)$

$\boxed{K_{x,y}(x,y) = 2.9387X10^{-174}/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10}, \frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5} \sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90), (99)], (9)1405.098$$

$$/days^2 \frac{2592000sec^4}{days^2}$$

$\hat{F}(x,y,t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 73. One-month Arithmetic Traffic count of ELWA-Harbel Junction

Eternal Love Winning All –Harbel Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	20968	0.496872	49.6872		2.012591
SB	11705	0.27737	27.73697		3.605297
LB	5564	0.131848	13.18483		7.584472
ST	1467	0.034763	3.476303		28.76619
MST	1349	0.031967	3.196682		31.28243
LT	1147	0.02718	2.718		36.7916
		1	100	100	
TOTAL	42200				

T & PC= Taxi and Private Car, **W=** Weight, **W%**=Weight Percent, **AW=** Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n} \sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij}} = \frac{n \ y^T w y}{\sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T w y}{\sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ \ (2.013)^{30days}(100)(2.013)}{\sum_{i=1}^{6} \sum_{i=1}^{6}(49.687)(2.013)^{30days}(2.013)}$$

$$I = \frac{6 \ \ (2.013)^{30days}(100)(2.013)}{(6)(6)(49.687)(2.013)^{30days}(2.013)}$$

$$I = \frac{(100)}{(6)(49.697)}$$

$$I = 0.335$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$$

$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$

$K_t(30) = (0.039904) \exp(-2.25)$

$K_t(30) = 1405.098014/days^2$

Solution of $K_{x,y}(x, y)$

Table 74. Motion and displacement Traffic count of ELWA-Harbel Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{900^2}{2(200)^2}\right) \exp(-\frac{990^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904) \exp(-10.125) \exp(-12.251)$

$K_{x,y}(x, y) = 1.4612X10^{14} exp(-12.251)$

$\boxed{K_{x,y}(x, y) = 2.9387X10^{-174}/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 2.9387X10^{-174}/sec^4 [\frac{900}{10}, \frac{990}{10}] 1.008/hr^2 (\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5} \sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90),(99)],(9)1405.098$$

$$/days^2 \frac{2592000sec^4}{days^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 75. One month Arithmetic Traffic count of Duport Road Junction

Duport Road Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	218070	0.904742	90.47421		1.105287
SB	12582	0.052201	5.220097		19.15673
LB	4447	0.01845	1.844999		54.20058
ST	1502	0.006232	0.623159		160.4727
MST	2814	0.011675	1.16749		85.65387
LT	1615	0.0067	0.670041		149.2446
		1	100	100	
TOTAL	241030				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n} \sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ \ (1.105)^{30days}(100)(1.105)}{\sum_{i=1}^{6} \sum_{i=1}^{6}(90.474)(1.105)^{30days}(1.105)}$$

$$I = \frac{6\ \ (1.105)^{30days}(100)(1.105)}{(6)(6)(90.474)(1.105)^{30days}(1.105)}$$

$$I = \frac{(100)}{(6)(90.474)}$$

$$I = 0.184$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$

$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$

$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$

$K_t(30) = (0.039904) \exp(-2.25)$

$K_t(30) = 1405.098014/days^2$

Solution of $K_{x,y}(x,y)$

Table 76. Motion and displacement Traffic count of Duport Road Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904) \exp\left(-\frac{900^2}{2(200)^2}\right) \exp(-\frac{990^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904) \exp(-10.125) \exp(-12.251)$

$K_{x,y}(x,y) = 1.4612X10^{14} exp(-12.251)$

$\boxed{K_{x,y}(x,y) = 2.9387X10^{-174}/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10}, \frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5} \sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90),(99)],(9)1405.098$$

$$/days^2 \frac{2592000sec^4}{days^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 77. One-month Arithmetic Traffic count of Nizohn Junction

Nizohn Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	245142	0.950808	95.08077		1.051737
SB	5713	0.022158	2.215844		45.12953
LB	1964	0.007618	0.761757		131.2755
ST	1486	0.005764	0.57636		173.5027
MST	1736	0.006733	0.673325		148.5167
LT	1784	0.006919	0.691942		144.5207
		1	100	100	
TOTAL	257825				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n} \sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ (1.086)^{30days}(100)(1.086)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(95.081)(1.052)^{30days}(1.052)}$$

$$I = \frac{6\ (1.086)^{30days}(100)(1.086)}{(6)(6)(95.081)(1.052)^{30days}(1.052)}$$

$$I = \frac{(100)}{(6)(95.081)}$$

$I = \ 0.185$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$$

$$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$$

$$K_t(30) = (0.039904) \exp(-2.25)$$

$$K_t(30) = 1405.098014/days^2$$

Solution of $K_{x,y}(x, y)$

Table 78. Motion and displacement Traffic count of Nizohn Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{900^2}{2(200)^2}\right) \exp(-\frac{990^2}{2(200)^2})$$

$$K_{x,y}(x, y) = (0.039904) \exp(-10.125) \exp(-12.251)$$

$$K_{x,y}(x, y) = 1.4612X10^{14} exp(-12.251)$$

$$\boxed{K_{x,y}(x,y) = 2.9387X10^{-174}/sec^4}$$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x},\frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10},\frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90),(99)],(9)1405.098$$

$$/days^2\,\frac{2592000sec^4}{days^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 79. One-month Arithmetic Traffic count of Gardnerville Junction

Gardnerville Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	175918	0.883318	88.33176		1.132096
SB	13554	0.068057	6.80572		14.69352
LB	4965	0.02493	2.493021		40.11198
ST	1544	0.007753	0.775272		128.987
MST	1823	0.009154	0.915363		109.2463
LT	1352	0.006789	0.678865		147.3047
		1	100	100	
TOTAL	199156				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i-y)(y_j-y)}{\sum_{i=1}^{n}(y_i-y)^2\ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{6\ (1.321)^{30days}(100)(1.321)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(88.332)(1.321)^{30days}(1.321)}$$

$$I = \frac{6\ (1.321)^{30days}(100)(1.321)}{(6)(6)(88.332)(1.321)^{30days}(1.321)}$$

$$I = \frac{(100)}{(6)(88.332)}$$

$$I = 0.189$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$$

$$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$$

$$K_t(30) = (0.039904) \exp(-2.25)$$

$$K_t(30) = 1405.098014/days^2$$

Solution of $K_{x,y}(x,y)$

Table 80. Motion and displacement Traffic count of Gardnerville Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904)\exp\left(-\frac{900^2}{2(200)^2}\right)\exp(-\frac{990^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904)\exp(-10.125)\exp(-12.251)$

$K_{x,y}(x,y) = 1.4612X10^{14}exp(-12.251)$

$\boxed{K_{x,y}(x,y) = 2.9387X10^{-174}/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10}, \frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90),(99)],(9)1405.098$$

$$/days^2\,\frac{2592000sec^4}{days^2}$$

$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 81. One-month Arithmetic Traffic count of Barnesville Junction

Barnesville Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	309204	0.870438	87.04381		1.148847
SB	12140	0.034175	3.417523		29.26096
LB	10637	0.029944	2.994415		33.39551
ST	11159	0.031414	3.141363		31.83332
MST	11159	0.023804	2.380443		42.00899
LT	3632	0.010224	1.022442		97.80507
		1	100	100	
TOTAL	355228				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i-y)(y_j-y)}{\sum_{i=1}^{n}(y_i-y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.149)^{30days}(100)(1.149)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(87.044)(1.149)^{30days}(1.0149)}$$

$$I = \frac{6 \ (1.149)^{30days}(100)(1.149)}{(6)(6)(87.044)(1.149)^{30days}(1.0149)}$$

$$I = \frac{(100)}{(6)(87.044)}$$

$$I = 0.191$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$$

$$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$$

$$K_t(30) = (0.039904) \exp(-2.25)$$

$$K_t(30) = 1405.098014/days^2$$

Solution of $K_{x,y}(x,y)$

Table 82. Motion and displacement Traffic count of Barnesville Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904)\exp\left(-\frac{900^2}{2(200)^2}\right)\exp(-\frac{990^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904)\exp(-10.125)\exp(-12.251)$

$K_{x,y}(x,y) = 1.4612X10^{14}exp(-12.251)$

$\boxed{K_{x,y}(x,y) = 2.9387X10^{-174}/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x},\frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10},\frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90),(99)],(9)1405.098$$

$$/days^2\,\frac{2592000sec^4}{days^2}$$

$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 83. One-month Arithmetic Traffic count of SDA Junction

Seven Day Advantage (SDA) Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	56094	0.640116	64.01159		1.562217
SB	19739	0.225251	22.52513		4.439485
LB	1480	.016889	1.6889		59.21014
ST	6168	0.070386	7.038605		14.20736
MST	2782	0.031747	3.174676		31.49928
LT	1368	0.015611	1.561091		64.05775
		1	100	100	
TOTAL	87631				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i-y)(y_j-y)}{\sum_{i=1}^{n}(y_i-y)^2\ \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^Twy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^Ty}$$

$$I = \frac{n \ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.562)^{30days}(100)(1.562)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(64.012)(1.562)^{30days}(1.562)}$$

$$I = \frac{6 \ (1.562)^{30days}(100)(1.562)}{(6)(6)(64.012)(1.562)^{30days}(1.562)}$$

$$I = \frac{(100)}{(6)(64.012)}$$

$$I = 0.260$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$$

$$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$$

$$K_t(30) = (0.039904) \exp(-2.25)$$

$$K_t(30) = 1405.098014/days^2$$

Solution of $K_{x,y}(x,y)$

Table 84. Motion and displacement Traffic count of SDA Junction

Time (second)	**Speed (m/sec)**	**X (meter)**	**Acceleration (m/sec2)**	**Y = X + Vt**
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904)\exp\left(-\frac{900^2}{2(200)^2}\right)\exp(-\frac{990^2}{2(200)^2})$$

$$K_{x,y}(x,y) = (0.039904)\exp(-10.125)\exp(-12.251)$$

$$K_{x,y}(x,y) = 1.4612X10^{14}exp(-12.251)$$

$$\boxed{K_{x,y}(x,y) = 2.9387X10^{-174}/sec^4}$$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10}, \frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90),(99)],(9)1405.098$$

$$/days^2\,\frac{2592000sec^4}{days^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 85. One-month Arithmetic Traffic count of SKD Boulevard Junction

Samuel Kanyan Doe (SKD) Boulevard Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	313919	0.976037	97.60374		1.024551
SB	2867	0.008914	0.891408		112.1821
LB	1035	0.003218	0.321802		310.7498
ST	2217	0.006893	0.68931		145.0726
MST	1397	0.004344	0.434355		230.2262
LT	191	0.000594	0.059386		1683.906
		1	100	100	
TOTAL	321626				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n} \sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \ \sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij}} = \frac{n \ y^T wy}{\sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T wy}{\sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.025)^{30days}(100)(1.025)}{\sum_{i=1}^{6} \sum_{i=1}^{6}(97.604)(1.025)^{30days}(1.025)}$$

$$I = \frac{6 \ (1.025)^{30days}(100)(1.025)}{(6)(6)(97.604)(1.025)^{30days}(1.025)}$$

$$I = \frac{(100)}{(6)(97.604)}$$

$$I = 0.171$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$$

$$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$$

$$K_t(30) = (0.039904) \exp(-2.25)$$

$$K_t(30) = 1405.098014/days^2$$

Solution of $K_{x,y}(x, y)$

Table 86. Motion and displacement Traffic count of S K D Boulevard Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904) \exp\left(-\frac{900^2}{2(200)^2}\right) \exp(-\frac{990^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904) \exp(-10.125) \exp(-12.251)$

$K_{x,y}(x,y) = 1.4612X10^{14} exp(-12.251)$

$\boxed{K_{x,y}(x,y) = 2.9387X10^{-174}/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_x h_y h_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)} \sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10}, \frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5} \sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90), (99)], (9)1405.098$$

$$/days^2 \frac{2592000sec^4}{days^2}$$

$\hat{F}(x,y,t) = 6.666X10^{-5} \sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 87. One-month Arithmetic Traffic count of University of Liberia-Executive Mansion Junction

University of Liberia -Executive Mansion Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	317595	0.917001	91.70009		1.090512
SB	20306	0.05863	5.863008		17.05609
LB	6750	0.019489	1.948946		51.30978
ST	1611	0.004651	0.465149		214.9851
MST	56	0.000162	0.016169		6184.661
LT	23	0.0000641	0.006641		15058.3

		1	100	100	
TOTAL	346341				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y=** Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n} \sum_{j=1}^{n} \omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \ \sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij}} = \frac{n \ y^T w y}{\sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij} \ \ y^T y}$$

$$I = \frac{n \ y^T w y}{\sum_{i=1}^{n} \sum_{i=1}^{n} \omega_{ij} \ \ y^T y}$$

$$I = \frac{6 \ (1.091)^{30days}(100)(1.091)}{\sum_{i=1}^{6} \sum_{i=1}^{6}(91.700)(1.091)^{30days}(1.091)}$$

$$I = \frac{6 \ (1.091)^{30days}(100)(1.091)}{(6)(6)(91.700)(1.091)^{30days}(1.091)}$$

$$I = \frac{(100)}{(6)(91.700)}$$

$$I = 0.182$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$$

$$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$$

$$K_t(30) = (0.039904) \exp(-2.25)$$

$$K_t(30) = 1405.098014/days^2$$

Solution of $K_{x,y}(x, y)$

Table 88. Motion and displacement Traffic count of the University of Liberia-Executive Mansion Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$K_{x,y}(x,y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x,y) = (0.039904)\exp\left(-\frac{900^2}{2(200)^2}\right)\exp(-\frac{990^2}{2(200)^2})$$

$K_{x,y}(x,y) = (0.039904)\exp(-10.125)\exp(-12.251)$

$K_{x,y}(x,y) = 1.4612X10^{14}exp(-12.251)$

$\boxed{K_{x,y}(x,y) = 2.9387X10^{-174}/sec^4}$

$\hat{F}(x,y,t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x},\frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10},\frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90),(99)],(9)1405.098$$

$$/days^2\,\frac{2592000sec^4}{days^2}$$

$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 89. One month Arithmetic Traffic count of S D Cooper Junction

South Detuwal Cooper Junction Direction

Vehicles Name	Amount of Vehicle Passages	W	W%	AW%	Y
T & PC	190217	0.909942	90.9942		1.098971
SB	14420	0.068981	6.898102		14.49674
LB	2419	0.011572	1.157178		86.41711
ST	857	0.0041	0.409964		243.9242
MST	940	0.004497	0.449668		222.3862
LT	190	0.000909	0.09089		1100.226
		1	100	100	
TOTAL	209043				

T & PC= Taxi and Private Car, **W**= Weight, **W%**=Weight Percent, **AW**= Average Weight Percent, **Y**= Average of Vehicle pass per month

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n \sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2 \ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T w y}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{n\ y^T w y}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij} \ \ y^T y}$$

$$I = \frac{6\ \ (1.099)^{30days}(100)(1.099)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(90.994)(1.099)^{30days}(1.099)}$$

$$I = \frac{6\ \ (1.099)^{30days}(100)(1.099)}{(6)(6)(90.994)(1.099)^{30days}(1.099)}$$

$$I = \frac{(100)}{(6)(90.994)}$$

$$I = 0.183$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x, y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}}\exp(-\frac{1t_i^2}{2\sigma})$$

$$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}}\exp(-\frac{30^2}{2(200)})$$

$$K_t(30) = \frac{1}{25.05998}\exp(-\frac{900}{400})$$

$K_t(30) = (0.039904)\exp(-2.25)$

$K_t(30) = 1405.098014/days^2$

Solution of $K_{x,y}(x, y)$

Table 90. Motion and displacement Traffic count of S D Cooper Road Junction

Time (second)	**Speed (m/sec)**	**X (meter)**	**Acceleration (m/sec2)**	**Y = X + Vt**
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}}\exp\left(-\frac{1x_i^2}{2\sigma^2}\right)\exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904)\exp\left(-\frac{900^2}{2(200)^2}\right)\exp(-\frac{990^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904)\exp(-10.125)\exp(-12.251)$

$K_{x,y}(x, y) = 1.4612X10^{14}exp(-12.251)$

$\boxed{K_{x,y}(x, y) = 2.9387X10^{-174}/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_xh_yh_t}\sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}]K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x, y, t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10}, \frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90),(99)],(9)1405.098$$

$$/days^2\,\frac{2592000sec^4}{days^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 91. One month Arithmetic Traffic count of President Bye Pass Junction

President Bye Pass Junction Direction					
Vehicles Name	**Amount of Vehicle Passages**	**W**	**W%**	**AW%**	**Y**
T & PC	41309	0.654421	65.44207		1.528069
SB	17857	0.282892	28.28921		3.534916
LB	650	0.010297	1.029736		97.11231
ST	1853	0.029355	2.935539		34.0653
MST	984	0.015589	1.558861		64.14939
LT	470	0.007446	0.744578		134.3043
		1	100	100	
TOTAL	63123				

Spatial autocorrelation exploration using Moran Theorem

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(y_i - y)(y_j - y)}{\sum_{i=1}^{n}(y_i - y)^2\ \sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}} = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{n\ y^T wy}{\sum_{i=1}^{n}\sum_{i=1}^{n}\omega_{ij}\ \ y^T y}$$

$$I = \frac{6\ (1.528)^{30days}(100)(1.528)}{\sum_{i=1}^{6}\sum_{i=1}^{6}(65.442)(1.528)^{30days}(1.528)}$$

$$I = \frac{6\ (1.528)^{30days}(100)(1.528)}{(6)(6)(65.442)(1.528)^{30days}(1.528)}$$

$$I = \frac{(100)}{(6)(65.442)}$$

$$I = 0.255$$

Trend surface analysis

Multivariate Gaussian kernel: we have the value of $K_t(t)$ and $K_{x,y}(x,y)$

Where $t = 30days, \pi = 3.14, \sigma = 200$

$K_t(t) = \frac{1}{\sqrt{2\pi\sigma}} \exp(-\frac{1t_i^2}{2\sigma})$

$K_t(30) = \frac{1}{\sqrt{2(3.14)(200)}} \exp(-\frac{30^2}{2(200)})$

$K_t(30) = \frac{1}{25.05998} \exp(-\frac{900}{400})$

$K_t(30) = (0.039904) \exp(-2.25)$

$K_t(30) = 1405.098014/days^2$

Solution of $K_{x,y}(x, y)$

Table 92. Motion and displacement Traffic count of President Bye Pass Junction

Time (second)	Speed (m/sec)	X (meter)	Acceleration (m/sec2)	Y = X + Vt
90	10	900	0.111111	990
180	10	1800	0.055556	1980
270	10	2700	0.037037	2970
360	10	3600	0.027778	3960
450	10	4500	0.022222	4950
540	10	5400	0.018519	5940

$K_{x,y}(x, y) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{1x_i^2}{2\sigma^2}\right) \exp(-\frac{1y_i^2}{2\sigma^2})$

But $\frac{1}{\sqrt{2\pi\sigma}} = (0.039904)$

$$K_{x,y}(x, y) = (0.039904) \exp\left(-\frac{900^2}{2(200)^2}\right) \exp(-\frac{990^2}{2(200)^2})$$

$K_{x,y}(x, y) = (0.039904) \exp(-10.125) \exp(-12.251)$

$K_{x,y}(x, y) = 1.4612X10^{14} exp(-12.251)$

$\boxed{K_{x,y}(x, y) = 2.9387X10^{-174}/sec^4}$

$\hat{F}(x, y, t) = \frac{1}{nh_x h_y h_t} \sum_{i=1}^{n} K_{x,y}[\frac{x-x_i}{h_x}, \frac{y-y_i}{h_y}] K_t(\frac{t-t_i}{h_t})$ but $h_x > 0, h_y > 0, h_t > 0$, n= 6

$$\hat{F}(x,y,t) = \frac{1}{15(10)(10)(10)}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[\frac{900}{10},\frac{990}{10}]1.008/hr^2(\frac{90}{10})$$

$$\hat{F}(x,y,t) = 6.666^{-5}\sum_{i=1}^{6} 2.9387X10^{-174}/sec^4[(90),(99)],(9)1405.098$$

$$/days^2\,\frac{2592000sec^4}{days^2}$$

$$\hat{F}(x,y,t) = 6.666X10^{-5}\sum_{i=1}^{6} 0.2424, 0.26664,\ (3)7.72X10^{-8}$$

$$\hat{F}(x,y,t) = (1.0578X10^{-175}, 1.1636X10^{-175}, 1.9513X10^{-6})$$

Table 93. One month Values of Moran (I) and kernel { k(t), K(x,y), and Trend Surface F(x,y,t)]

Name	I	K(t)	K(x,y)	F(x,y,t)
Voice of America (VOA) Junction Direction	0.225	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Rehab Junction Direction	0.287	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Thinker Village Junction Direction	0.242	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
President Church Junction Direction	0.219	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Eternal Love Winning All (ELWA) Hospital Junction Direction	0.170	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Eternal Love Winning All (ELWA) - Harbel Junction Direction	0.335	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Duport Road Junction Direction	0.335	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Nizohn Junction Direction	0.184	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Gardnerville Junction Direction	0.185	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Barnesville Junction Direction	0.189	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$

Seven Day Advantage (SDA) Junction Direction	0.260	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
Samuel Kanyan Doe (SKD) Boulevard Junction	0.171	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
University of Liberia-Executive Mansion Direction	0.182	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
South Detuwal Cooper Junction Direction	0.183	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$
President Bye Pass Junction Direction	0.235	5.4243^{-5}	$2.9387X10^{-174}$	$1.0578X10^{-175}$ $1.1636X10^{-175}$ $1.9513X10^{-6}$

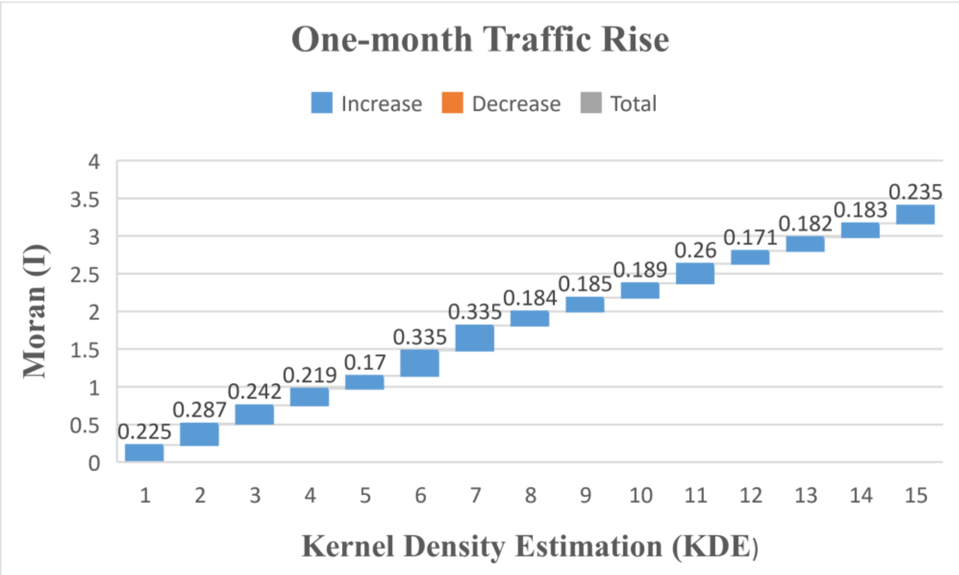


Fig. 3. Rise in traffic for one month

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DELHI TECHNOLOGICAL UNIVERSITY
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Proforma for Submission of M.Tech. Major Project

01. Name of the Student: Cooper B. Saysay
02. Enrolment No: 2K20/GINF/10
03. Year of Admission: 2020
04. Programme M.Tech., Branch: Geoinformatics
05. Name of Department: Civil Engineering
06. Admission Category i.e. Full Time/ Full Time (Sponsored)/ Part Time: Full Time
07. Applied as Regular/ Ex-student: Regular
08. Span Period Expired on: May 2022
09. Extension of Span Period Granted or Not Granted (if applicable).........
10. Title of Thesis/ Major Project: Spatial Analysis of Traffic Congestion of Monrovia and Its Suburbs
11. Name of Supervisor: Prof. K.C. Tiwari
12. Result Details (Enclose Copy of Mark sheets of all semesters) :

S. No.	Semester	Passing Year	Roll No.	Marks Obtained	Max. Marks	% of Marks	Details of Back Paper Cleared (if any)
01	1st		2K20/GINF/10	4.76	10	47.6%	
02	2nd		2K20/GINF/10	6.82	10	68.2%	
03	3rd		2K20/GINF/10	7.50	10	75.0%	
04	4th (P/T only)		2K20/GINF/10				
05	5th (P/T only)						

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Master of Technology in Geoinformatics

(Multidisciplinary Centre for Geoinformatics)

Name : COOPER B SAYSAY **Roll No.** : 2K20/GEO/10

Month & Year of Examination : DECEMBER , 2020 **Semester** : FIRST

Subject Code	Subject Title	Credits	Credits Secured	Grade
GEO501	REMOTE SENSING, PHOTOGRAMMETRY AND SATELLITE IMAGE PROCESSING	4	4	P
GEO503	INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEM AND WEB GIS	4	4	C
GEO5201	TWO WEEK SURVEY AND MAPPING CAMP (LOCAL)	2	2	C
GEO5301	PROBABILITY, STATISTICS AND INFORMATION THEORY IN GEOINFORMATICS	3	3	C
GEO5401	SURVEYING, SATELLITE GEODESY, GPS/GNSS	4	4	C
		17	17	

AB : Absent DT : Detained

Credits Secured / Total : 17 / 17 **SGPA :** 4.76

CONTROLLER OF EXAMINATIONS

Dated : May 27, 2022

Date of Declaration of Result Mar 15, 2021

S. No. 307112

DELHI TECHNOLOGICAL UNIVERSITY

(Formerly Delhi College of Engineering)

STATEMENT OF GRADES

Master of Technology in Geoinformatics

(Multidisciplinary Centre for Geoinformatics)

Name : COOPER B SAYSAY **Roll No. : 2K20/GEO/10**

Month & Year of Examination : MAY , 2021 **Semester : SECOND**

Subject Code	Subject Title	Credits	Credits Secured	Grade
GEO502	PRINCIPLES OF OPTICAL, THERMAL AND HYPERSPECTRAL REMOTE SENSING	4	4	B
GEO504	MICROWAVE AND LIDAR REMOTE SENSING	4	4	B+
GEO5402	ADVANCE IMAGE PROCESSING IN GEOINFORMATICS	4	4	A
GEO5302	MODELING AND ANALYSIS OF GEOSPATIAL DATA	3	3	B
GEO5202	RESEARCH METHODS AND COMMUNICATION	2	2	B+
		17	17	

AB : Absent DT : Detained

Credits Secured / Total : 17 / 17 **SGPA : 6.82**

Dated : Mar 8, 2022

CONTROLLER OF EXAMINATIONS

Date of Declaration of Result Jun 29, 2021

S. No. 319718

DELHI TECHNOLOGICAL UNIVERSITY

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STATEMENT OF GRADES

Master of Technology in Geoinformatics

(Multidisciplinary Centre for Geoinformatics)

Name : COOPER B SAYSAY **Roll No.** : 2K20/GEO/10

Month & Year of Examination : NOVEMBER , 2021 **Semester** : THIRD

Subject Code	Subject Title	Credits	Credits Secured	Grade
GEO601	MAJOR PROJECT I	3	3	B+
GEO6205	APPLICATION OF GEOINFORMATICS URBAN PLANNING AND INFRASTRUCTURE	2	2	B+
GEO6301	APPLICATION OF GEOINFORMATICS IN DISASTER MANAGEMENT	3	3	A+
GEO6401	APPLICATION OF GEOINFORMATICS IN TARGET DETECTION	4	4	B+
		12	12	

AB : Absent DT : Detained

Credits Secured / Total : 12 / 12 **SGPA : 7.50**

Dated : Mar 4, 2022

CONTROLLER OF EXAMINATIONS

Date of Declaration of Result Jan 31, 2022

REGISTRAR, DTU (RECEIPT A/C)

BAWANA ROAD, SHAHABAD DAULATPUR, , DELHI-110042

Date: 31-May-2022

e-Receipt for State Bank Collect Payment

SBCollect Reference Number	DUJ0775163
Category	Miscellaneous Fees from students
University Roll No	2K20/GINF/10
Name of the student	Cooper B. Saysay
Academic Year	2020-2022
Branch Course	M.Tech Geoinformatics
Type/Name of fee	Others if any
Mobile No. of the student	7303336139
Fee Amount	2000
Transaction charge	0.00
Total Amount (In Figures)	2,000.00
Total Amount (In Words)	Rupees Two Thousand Only
Remarks	Thesis Fees Payment
Notification 1	Late Registration fee Rs.50 per day, Hostel Room Rent for internship Rs.1000 per month, Hostel Cooler Rent Rs.1000 per year, I card Rs.200, Character certificate Rs.200, Migration certificate Rs.200, Bonafide certificate Rs.200, Special certificate Rs.500, Provisional certificate Rs.200, Duplicate Mark sheet Rs.500, Training Diary Rs.70
Notification 2	Fee Structure Rs.200, Admit Card Rs.50. Transcript fee and other fee rates has to be confirmed from the Academic Cell prior to remit the fees online by the student.