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Analysis of Performance for Al Salam Roundabout in Benghazi Libya

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Abstract: Search provided is Empirical Study of Multi-roundabout object in Benghazi Libya claims ALSALAM roundabout and it is one of the largest courses in the city of Benghazi, because of its importance you examine the situation of congestion worsening because of the traffic around the roundabout, which requires knowledge of the characters of this congestion and know all the reasons. It is contains an introduction to include on the background of the subject matter described the details of the study site and also the population of the city of Benghazi as there are details of the study area and its environs and to clarify the problem statement and objectives of the study, which aims to develop a solution to this problem and finally contains a flow chart of the search. This chapter includes the theories of text analysis of traffic flow around the roundabout and also on the traffic analysis equations Following the Indonesian Code (IHCM) where there is utmost account transactions, including the rotor conclude degree of saturation of the roundabout compared to the traffic flow with the traffic capacity.

Find ways to be followed for the collection of traffic data and also how to conduct assessment of dizziness and data collection times . The result of the survey data the maximum peak period begins (8:15 -9:15) AM this principle, we started the process of analysis and knowledge of degree of saturation of the rotor and was (0.66>0.75) is here in this case less than the allowable limits specified code Indonesian. A prospective study was developed for this roundabout and concluded that after two years, we need to develop this and also redesign roundabout. Here the conclusions and recommendations of this research, which recommends the development of the roundabout , starter the solution of this roundabout it is reduce the diameter of roundabout , so that we can increase the total of the capacity for the passage of vehicles on the roundabout through development the geometric data of the roundabout.

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I. INTRODUCTION

Benghazi is the second largest city in Libya, the population of the entire district was 500,120 in 1995 (census) and has increased to 1.105,000 in the 2012 census As vehicle demands continue to increase on the nation's highways, previously overlooked highway elements will become critical to highway optimization and operation.

Much research exists analyzing highway operations during peak demand periods. This research shows that urban freeways can perform adequately until a disturbance, such as a traffic crash, occurs. Recurring localized operational problems such as overloaded weaving sections have also been analyzed, albeit, to a much lesser extent. While it is clear from this previous research that safety and mobility can be improved through the use of a well-designed weaving section, do not know the impact that many of the design decisions have on the current and future performance of roundabouts.

The Libya country has limited experience in studying major weaving sections but has a number of weaving sections in operation on the highway system. Operational problems with freeway weaving sections are routinely being experienced on the highway system. These problems include congestion as well as delays caused by incidents in weaving sections. A direct benefit of this project would provide analysis and guidance for staff in the use of the traffic Software Integrated System simulation modeling programs that were developed. In addition to the analysis of these methods, also anticipates direct benefits in the evaluation of a case study of a weaving section of the Interstate corridor in that Benghazi city is currently exhibiting operational problems.

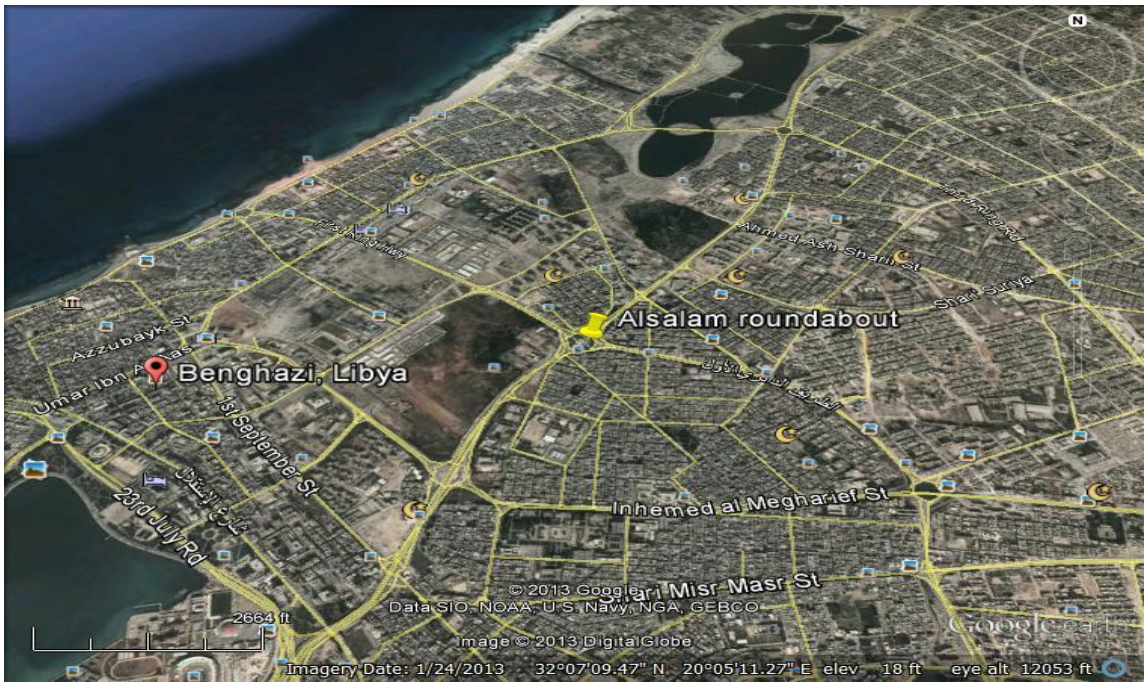

Figure 1.1 Alsalam roundabout location in Benghazi

Vehicular traffic movement around ALSALAM roundabout

ALSALAM roundabout is one of the main roundabouts in Benghazi, where transit vehicles from the northern regions to areas surrounded by residential neighborhoods, banks, public area and centers of either the southern region, which represents the commercial markets and universities As for the east and is the western regions are also the most important trends, which contain residential areas, schools and services buildings, and make that distinguishes this deployment site roundabout from several centers functional distributed evenly around the roundabout.

Details vehicular traffic around the roundabout peace is of great importance in the city of Benghazi because of light and heavy vehicles outside of the direction of the north and heading towards the rest of the directions of the three other example reflect light vehicles from the northern region, which includes mostly residential areas and other green areas to areas of the South, the most movement passage because it includes schools, universities, and other areas of commercial banks. The distribution of vehicular traffic on the semi-circle of equal proportion because each areas surrounding the roundabout considered equal in activities and distribution facilities

II. LITERATURE REVIEW

It contains a description of the basics of theories concerning, the theories evaluate this roundabout and its properties, statistical methods, and studies previous similar not ever do as well as contains clauses include clarifying interchange roundabout, types and how to design when needed and he also includes an introduction to bridges and concrete types.

Problem Statement

- The problem statement is taken into consideration the increasing congestion caused by irregular traffic and mixed between transit vehicles and heavy vehicles as well as public transport this region, making it the main cause of the phenomenon of traffic accidents in this range.
- There are four directions in the problem area a trend residential neighborhoods, schools, universities and commercial area and the main road leading to the hospital and area sports so When stand to do the survey ,should conclude that the roundabout as the northward residential neighborhoods and commercial centers, schools and other activities free and can show that the peak time in this direction be in two phases the first time the morning where the passage of the largest number of private vehicles to schools, commercial centers and either second time until the end of the official working hours at noon which is the time you return from work, here in this case generated cause of congestion of traffic accidents.
- As vehicle demands continue to increase on the nation's highways, previously overlooked highway elements will become critical to highway optimization and operation. Much research exists analyzing highway operations during peak demand periods. This research shows that urban freeways can perform adequately until a

disturbance, such as a traffic crash, occurs. Recurring localized operational problems such as overloaded weaving sections have also been analyzed, albeit, to a much lesser extent. While it is clear from this previous research that safety and mobility can be improved through the use of a well-designed weaving section, we do not know the impact that many of the design decisions have on the current and future performance of weaving sections.

- Weaving sections currently are designed in accordance with the Highway Capacity Manual. Highway Administration recognized a need to analyze the effectiveness of this procedure and consider other tools in assessing the performance and forecasting of weaving sections. A direct benefit of this project would provide analysis and guidance for staff in the use of the modeling programs that were developed.
- In addition to the analysis of these methods, also anticipates direct benefits in the evaluation of a case study of a weaving section of the Interstate corridor in that Benghazicity is currently exhibiting operational problems.

Objectives Of Study

- The purpose of this study is proposed to solve the problem at a roundabout, using modern methods aimed at achieving security and transport to ensure the operation vehicular traffic on a regular basis for all types of vehicles depending on the classification of roads through the road network and connectors.
- The purpose and goal of the and sometimes when they exceed the speed of motorists speed limit on the rotor to the occurrence of traffic accidents first evaluate the efficiency of the roundabout in the proposed research topic is to find a solution to level of service of the roundabout and interference of vehicles in lines functioning of sun and that is causing a traffic jam terms of vehicular power and then find a suitable solution to this problem.

Literature Review

This research study current practices for weaving section design and their development. Current methodologies and modeling techniques were assessed and then tested with the operating characteristics of a major weave section in Libya . The analysis compared the estimated level of service for the existing configuration and alternative designs to evaluate operational improvement opportunities. A safety analysis for collision type and severity was developed from the history of accidents through the weaving section and used to estimate collision reduction opportunities from the alternative designs. The study recommended that weaving sections undergo critical review of traffic projections and roadway characteristics before implementation to avoid operational impacts that may extend beyond the weaving section. Further research on the safety impacts in weaving sections is also recommended.

Capacity C and the other related performance measures degree of saturation DS, delay D (sec/pcu) and queue probability QP% for roundabout weaving sections; and travel speed V (km / h) and travel time TI' (sec/pcu) for single weaving sections are calculated for a given geometry, environment and traffic as follows, see Figure

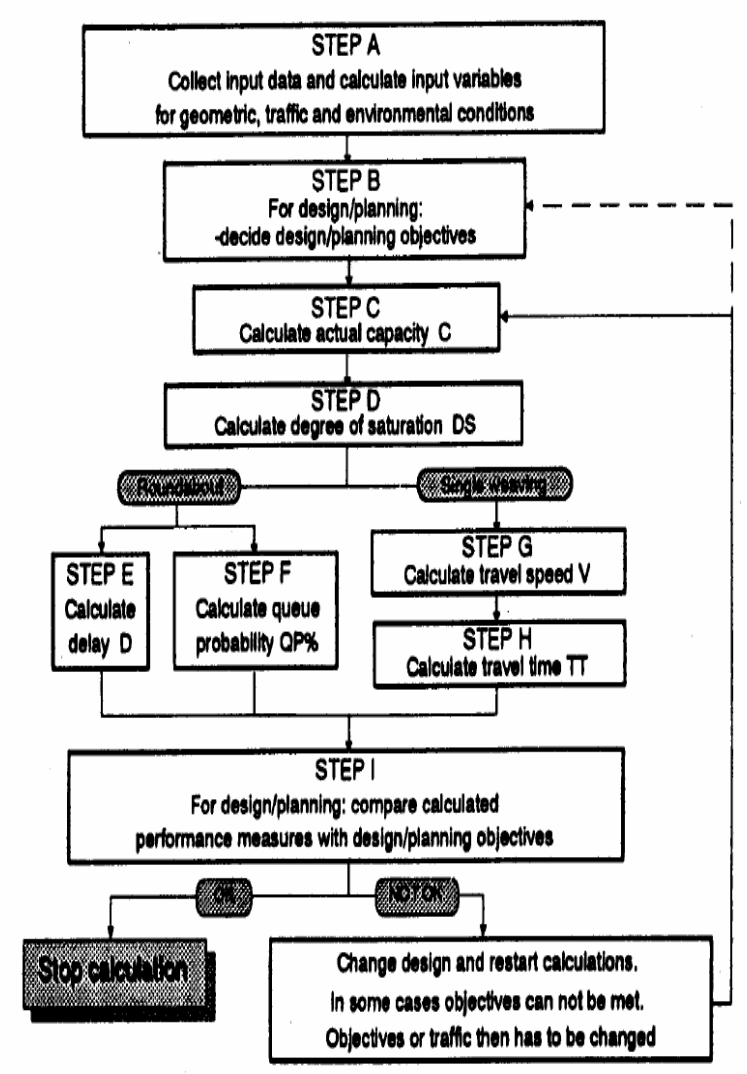

Figure 1.1 setps of analysis calculations

Research Methodology

It contains a description of the stages of mentality, and search procedures on the type of data used in the analysis here for this roundabout we need to know the traffic volume of the passing vehicles on the roundabout and the methods of analysis used.

III. ANALYSIS OF DATA AND RESULTS

Data of traffic volume flow for the roundabout ,the survey was conducted traffic during working days on Tuesday to be considered the middle day of the official time in all the institutions, universities and others.

Data volume of traffic crossing the road or obtained by surveying the traffic counting on roads to three directions. Tables showing the realty peak hours vehicular traffic movement around the roundabout and also to know the traffic volume for all directions during the morning beginning at (8:00-9:30) am and the afternoon be the start of (13:00-14:30) pm, As for the evening it is starting from (18:00-19:30) pm. Table 1.1 explain morning time period and max. peak hour around the roundabout , it is conducted (8:00-9:00)am so the reasons of this peak hour the movement of vehicles throw to schools and universities also work time for almost of people .

Table 1.1 peak hours at morning time

Time begins	Vehicle movement North bound Veh./h	South bound Veh./h	East bound Veh./h	West bound Veh./h	Total veh.
8:00-9:00	1744	1730	1687	1608	6769
8:15-9:15	1776	1726	1698	1589	6789
8:30-9:30	1782	1778	1615	1582	6757

In the Table 1.2 explain afternoon time period and max. peak hour around the roundabout , it is conducted (13:00-14:00)pm , that is mean when start the end of work time for schools and universities also work time end.

Table 1.2 peak hours at afternoon time

Time begins	Vehicle movement North bound Veh./h	South bound Veh./h	East bound Veh./h	West bound Veh./h	Total veh./h
13:00-14:00	1823	1680	1621	1515	6639
13:15-14:15	1737	1636	1617	1484	6474
13:30 - 14:30	1668	1661	1601	1456	6386

In the Table 1.3 explain evening time period and max. peak hour around the roundabout , it is conducted (18:30-19:30)pm because there are many people going to shopping and spend afternoon time in stadium so on .

Table 1.3 peak hour at evening time

Time begin	Vehicle movement North bound Veh./h	South bound Veh/h	East bound Veh./h	West bound Veh./h	Total veh./h
18:00-19:00	1396	1567	1530	1510	6003
18:15-19:15	1414	1546	1495	1547	5972
18:30-19:30	1437	1579	1462	1531	6009

Based on the tables result found the highest peak hour within the morning time (8:15-9:15) arm and equal to 6789 veh/h and table 1.4 explain the details of this peak hour for all directions .

Table 1.4 details of peak hour

Approach	Traffic movement ST Veh./h	LT Veh./h	RT Veh./h	UT Veh./h
A (W)	561	492	473	63
B (N)	617	556	541	62
C (E)	606	536	491	65
D (S)	515	566	576	69

Table 1.5 Roundabout geometric data

Alt. sec.	W1 (m)	W2 (m)	WE (m)	W (m)	WE/W (m)	L (m)	W/L (m)
BA	7.5	10	8.75	10	0.88	66	0.15
CB	7.5	10	8.75	10	0.88	39	0.26
DC	7.5	10	8.75	10	0.88	107	0.10
AD	7.5	10	8.75	10	0.88	78.5	0.13

In the Table 1.6 show calculations of the traffic flow data and weaving flow which need to calculate the degree of saturation.

Table 1.6 Actual flow

ALT. Sec.	Actual flowQv (veh./h)	Weaving flow Qw (veh./h)	W %
BA	3681	2440	66%
CB	3465	2350	68%
DC	3525	2268	64 %
AD	3504	2358	67%

Table 1.7. Traffic movement in (appendix B) show how to find PCU factor of traffic composition at roundabout as follow:

sum of light veh.						sum of heavy veh.				
	W	E	S	*N*			W	E	S	*N*
	A	C	D	*B*			A	C	D	*B*
LT	71	110	95	*76*		LT	52	61	34	*44*
ST	97	102	80	*96*		ST	37	39	53	*42*
RT	69	88	83	*78*		RT	56	46	39	*40*
UT	17	13	12	*9*		UT	4	6	9	*7*
LT	91	87	111	*82*		LT	58	28	33	*58*
ST	87	109	73	*98*		ST	39	45	48	*53*
RT	66	90	86	*88*		RT	32	30	32	*65*
UT	11	5	6	*8*		UT	6	2	6	*2*
LT	77	84	106	*98*		LT	24	32	50	*59*
ST	112	113	98	*113*		ST	36	39	48	*67*
RT	96	81	114	*89*		RT	50	28	38	*55*
UT	9	11	13	*14*		UT	9	8	6	*10*
LT	72	95	92	*98*		LT	47	39	45	*41*
ST	98	104	77	*104*		ST	55	55	38	*44*
RT	75	84	148	*87*		RT	29	44	36	*39*
UT	4	16	15	*8*		UT	3	4	2	*4*
	1052	1192	1209	1146			537	506	517	630
	Total veh.		4599				Total veh.		2190	
	Total veh = 4599 + 2190 = 6786									
68%						32%				

Lv = 68% ,Hv= 32% , Factor Pcu= 1*68 +1.3*32 =109.6

Actual traffic flow around Alsalam roundabout show in table 4.7 and calculate passengers cars factor to get (Qp) use to find degree of saturation (DS).

Table 1.8 pcu factor

Alt. sec.	Actual flow QVveh./h	Factor Pcu %	Qp (Pcu/h)
BA	3681	109.6	4034
CB	3465	109.6	3798
DC	3525	109.6	3863
AD	3504	109.6	3840

Analysis 0f traffic data

Table 1.8 show the result of analysis of traffic data around Alsalam roundabout and there are many factors to calculate the capacity of roundabout

Table 1.8 analyses of peak hour data

ROUNDABOUT WEAVING SECTION FORM RWEAVII: - ANALYSIS	Date :	Handled by:
	City : BENGHAZI	City Size M.inh: 1.105.000
	Road A-C : EAST-WEST	Road environment:
	Road B-D :NORTH - SOUTH	Side friction:
	Case :	Period:

- Geomeric weaving section prameters

Weaving Section	Weaving Section flow Pcu/h	Degree of saturation DS=Q/C (31) /(28)	Traffic delay DT Fig.C-2:1 sec/pcu	Traffic delay DT_{TOT} = QxDT (31) x (33) sec/h	Queue Probability QP% Fig.C-3:1	Objectives

	Weaving Section	Entry Width Appr.1	Entry Width Appr.2	Averange entry width W_E	Weaving width W_W	W_E/W_W	Weaving length L_W	W_E/L_W
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	BA	7.5	10	8.75	10	0.88	66	0.15
2	CB	7.5	10	8.75	10	0.88	39	0.26
3	DC	7.5	10	8.75	10	0.88	107	0.10
4	AD	7.5	10	8.75	10	0.88	78.5	0.13

- Capacity

	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
1	BA	2700	2.6	0.885	0.780	4846	1	0.94	4555
2	CB	2700	2.6	0.887	0.660	4110	1	0.94	3863
3	DC	2700	2.6	0.887	0.840	5230	1	0.94	4916
4	AD	2700	2.6	0.880	0.800	4942	1	0.94	4645

- Traffic performance

Weaving Section		Weaving Section flow Pcu/h	Degree of saturation DS=Q/C (31) /(28)	Traffic delay DT Fig.C-2:1 sec/pcu	Traffic delay DT_{TOT} = QxDT (31) x (33) sec/h	Queue Probability QP% Fig.C-3:1	Objectives
		(31)	(32)	(33)	(34)	(35)	
	(30)						(36)
1	BA	4034	0.89	7.5	30255	26 - 56	
2	CB	3798	0.98	13	49374	36 - 74	
3	DC	3863	0.78	5	19315	17 - 39	
4	AD	3840	0.83	6	23040	20 - 46	
5	DS Of roundabout DS_R		0.98	Total	121984		
6	Average roundaboutTraffic delay DT_R sec/pcu				20		
7	Average roundabout delay D_R=(DT_R +4)sec/pcu				24		
8	Roundabout queue probability QP%				36 - 74		

For calculating the increase in number of vehicles during the next years we need to know the average of number of family members, which make need to refer to the civil status office of the city to get on it also from some previous studies that have been conducted to determine the number of vehicles per family was average for each family 3 vehiclesand of all that is easy for us to calculate the average growth rate for vehicles and as shown in the attached table 1.9.

Table 1.9 No. of vehicle for family

Year	Population /year	Average of person number	Average of car / family	Number family	No. of veh./family
2012	1105000	6	3	184167	552500
2013	1171300	6	3	195217	585650
2014	1241578	6	3	206930	620790
2015	1316073	6	3	219346	658037

The following equation shows how to calculate the growth rate in the number of vehicles and taken from (http://pages.uoregon.edu/rgp/PPPM613/class8a.htm), when get growth rate in the number of vehicles must refer to calculate the traffic flow for every year :-

$$PR = \frac{Vfuture - Vpast}{Vpast} * 100$$

PR= present ratio

Vf= future value

Vp= past value

$$PR = \frac{658037 - 552500}{552500} = 19.1\%$$

Average PR= 19.1/4 = 4.8 %

We can deduce from the attached table in that is a degree of saturation up to the maximum value, also the value specified in the code Indonesian IHCM which is estimated at 0.80 as limited and the degree of saturation in 2014 exceeded that value.

Table 1.10 future study (2013-2016)

Year	approach	Growthingratio	C pcu/h	Qppcu/h	Qnpcu/h	DS=Qn/C
2013	A	1.048	4555	4034	4228	0.93
2013	B	1.048	3863	3798	3980	1.03
2013	C	1.048	4916	3863	4048	0.82
2013	D	1.048	4645	3840	4024	0.72
2014	A	1.1	4555	4034	4437	0.97
2014	B	1.1	3863	3798	4178	1.1
2014	C	1.1	4916	3863	4249	0.86
2014	D	1.1	4645	3840	4224	0.91
2015	A	1.15	4555	4034	4639	1.02
2015	B	1.15	3863	3798	4368	1.13
2015	C	1.15	4916	3863	4442	0.90
2015	D	1.15	4645	3840	4416	0.95
2016	A	1.21	4555	4034	4881	1.07
2016	B	1.21	3863	3798	4596	1.2
2016	C	1.21	4916	3863	4674	0.95
2016	D	1.21	4645	3840	4646	1.00

IV. CONCLUSIONS

Through the results of the analysis of geometric & traffic data conclude that the peak hours be distributed all over the periods between the morning and afternoon and evening, and so we adopted the maximum rush hour vehicle as is shown in table 4.1. Also note by the results of the final analysis of traffic data of this roundabout , there max. degree of saturation 1.2 in year 2016 , also that delay of this roundabout D (Sec/pcu) is the average delay per entering vehicle. Delay is estimated from the empirical relationship between delay D and degree of saturation DS, D equal 13, Queue probability Qp (%) is estimated from the empirical relationship between queue probability QP% and degree of saturation DS in this roundabout case more than (Qp 36 - 74%).

REFERENCE

[1]. Federal Highway Administration (FHWA). Manual on Uniform Traffic Control Devices. Washington, D.C.: FHWA, 1988.

[2]. Department of Transport (United Kingdom). Geometric Design of Roundabouts. TD 16/93. September 1993.

[3]. Transportation Research Board. Highway Capacity Manual.Special Report 209. Washington, D.C.: Transportation Research Board, National Research Council, July 1999 (draft).

[4]. Courage, K.G. "Roundabout Modeling in CORSIM." Presented at the Third International Symposium on Intersections without Traffic Signals, Portland, Oregon,U.S.A., 1997.

[5]. Paramics, Ltd. "Comparison of Arcady and Paramics for Roundabout Flows." Version 0.3. August 23, 1996.

[6]. Duncan, G. "Paramics Technical Report: Car-Following, Lane-Changing and Junction Modelling." Edinburgh, Scotland: Quadstone, Ltd., 1997.

[7]. Innovative Transportation Concepts, LLC. VISSIM User Manual. Program Version 2.32-2.36. November 10, 1997.

[8]. Modern Roundabout Practice in the United States ……. GEORGES JACQUEMART, P.E., AICP Buckhurst Fish & Jacquemart Inc.

[9]. Roundabouts An Informational Guid (Michael F. Trentacoste Director,)Office of Safety Research and Development.

[10]. INDONESIAN HIGHWAY CAPACITY MANUAL PART - I URBAN ROADS NO.09/T/BNKT/ 1993.

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