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Travel Time Prediction Models and Reliability Indices for Palestine Urban Road in Baghdad City

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Abstract

Travel Time estimation and reliability measurement is an important issues for improving operation efficiency and safety of traffic roads networks. The aim of this research is the estimation of total travel time and distribution analysis for three selected links in Palestine Arterial Street in Baghdad city. Buffer time index results in worse reliability conditions. Link (2) from Bab Al Mutham intersection to Al-Sakara intersection produced a buffer index of about 36% and 26 % for Link (1) Al-Mawall intersection to Bab Al- Mutham intersection and finally for link (3) which presented a 24% buffer index. These illustrated that the reliability get worst for link (2), (1) and (3) respectively during the peak period. Extra delay is observed on link(1), (2) and (3) in terms of 95% percentile travel time of about (301.9, 219.4, and 193.8)sec. for Link (1, 2 and 3) respectively. Higher value for 95% travel time is obtained for link (1). Travel time index (TTI) of 4.2 %, 4.9% and 4% is obtained for Link (1, 2 and 3) respectively. Maximum value for delay per km that obtained for link (1) which is about 266 sec/km and 268 sec./km for link (3) and 244 sec/km for link(2). Different predicted model for the three studied links of Palestine street have been developed based on the obtained field data. A best fit is presented as compared the predicted models with the observed field travel time data for all the models of studied links which illustrated that the predicted model can present the actual field data.

Keywords: *Delay, Buffer Index, Travel Time, predicted model, Reliability, Urban Arterial.*

1. Research Objective

The aim of this research is the estimation of total travel time and distribution analysis for three selected links in Palestine arterial street in Baghdad city which is considered as one of the most important residential and commercial area in Baghdad city due to dramatic change that produce potential pressure on daily trip generation and attraction. A statistical methods is needed to model travel time distribution on which reliability indices measurements including buffer index, buffer time and 95% percentile travel time were developed based on.

2. Introduction

The travel time of urban arterial in urban city played an important role in measuring the performance of traffic transportation system. Different studies are employed to model the distribution for travel time, [1], [2], [3] and [4] concluded for a lognormal distribution. Polus, (1979) concluded for a Gamma distribution; Al-Deek and Eman (2006) proposed a Weibull one [5], [6]. In Taylor and Susilawati (2012) and Susilawati et.al. (2012) the Burr distribution is adopted [7], [8]. Federal Highway Administration (FHWA) has defined travel time reliability is as consistency or dependability in travel time as measure from day to day and across different times of the day [9]. The 95th percentile travel time and Buffer Index (BI) and

Planning Time Index (PTI) considered as performance indicators for travel time reliability. Travel time distribution and empirical based approach is the base for development of these indices. Study of travel time reliability can help in understanding the variation in travel time and aid in transportation system management [10].

3. Study Area and Data Collected

3.1. Study Area

Palestine street is one of the most important major arterial streets in Baghdad city due to the majority of surrounded area of different mix land uses; commercial, educational and residential that provide potential pressure of generation and attraction additional daily trips. Palestine street is located in the East of Baghdad and it runs parallel to the west of Army Canal between Al-Mustansiriyah Sequare through Beirut square to the end of it at Maysalone sequar; 6 divided lane carriageway 3-lane in each direction. Figure (1) presents the three links that have been considered in this research namely as Link(1); From Al-Mawall Intersection to Bab Al-Muatham Intersection of 1.03 Km length, Link (2); From Bab Al-Muatham Intersection to Al-Sachara Intersection of 520m length, and Link (3); From Al-Sachara Intersection to Beirut Intersection of 620 m length respectively. The selected corridor for Palestine street links passed through three signalized intersection (Bab Al-Mutham Intersection, Al-Sachara Intersection and Bairuit Intersection) which also take into consideration their impedance and delay effect on travel time variability, reliability and distribution estimation.

3.2. Data Collection

The field data are collected for the selected sections of Palestine Street for Link (1), (2) and (3) respectively. Congestion of traffic conditions is taking the major part during peak hours of the day from (12:00 to 4:00 p.m.) on Monday 18 May and Tuesday 19 May 2016 which is selected to study the variations of total travel time and travel delay time for each link in the selected site of Palestine arterial street. GPS essentials measurement equipped with cell phone is applied to compute travel time with a 30 set of data point is recorded at peak period from (12:00 to 4:00 p.m.) on each selected link corridor. Figure (2) shows the control points for mapping the distance for acceleration and deceleration and starting of each link.

4. Results and Discussions

4.1. Analysis of Travel Time

In this research a consideration to congestion of traffic conditions is taking the major part during peak hours of the day from (12:00 to 4:00 p.m.) is preferred to study the variations of total travel time and travel delay time for each link in the selected site of Palestine arterial street.

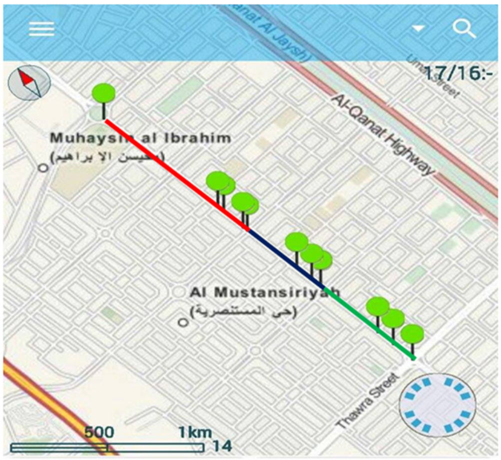


Fig. 1. Study Area Urban Arterial Palestine Street with Selected Three Links.

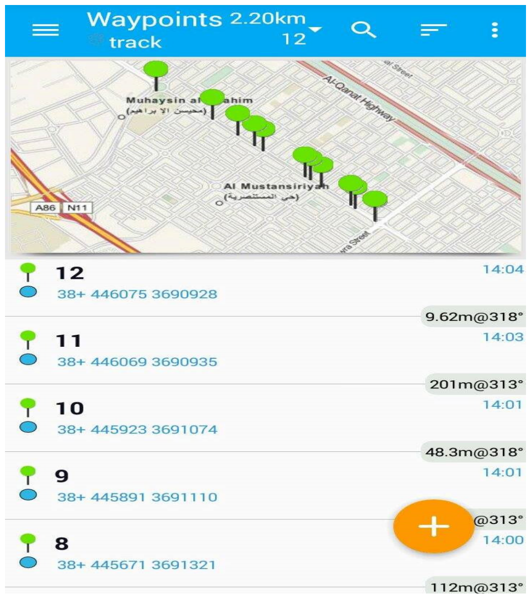


Fig. 2. Control Points for Deceleration, Acceleration and Stopping Time Measurement for Studied Links.

A number of sample run of 30 is provided for each link in the south direction as described from the link name in the previous section of site selection. Travel time analysis is required for measuring the performance and to have indication about the operation efficiency of Palestine arterial corridor. Figures (3), (4) and (5) clarified the variations of total travel time for each link including stop time and (acceleration and deceleration time). Figure (6) and (7) illustrated the travel time delay for each link; Travel time delay estimated from total travel time minus ideal travel time for each link depend on posted speed limit and distance for each one. Based on the obtained results shown in figures, link (1) from Al-Mawall to Bab-Al-Mutham intersection produced the highest values for travel and delay time than other two links due to several reasons which can be referred to the surrounded of commercial, residential and educational mix land use that produced and attracted a large number of daily trips also its attributed to the traffic condition of the link itself which controlled by a check point at the start of the route for the link near Al-Mwaal intersection and cause excess delay during the peak hours reach about 5 minutes stopping causing the state of stop and slow moving conditions for vehicles. Also its appeared that travel time varied during the time period and three maximum peak point at (12:00-1:00p.m), (1:30-2:30p.m) for all links and additional third peak point from (3:00-3:30) for link (1) were observed. Maximum travel time of 518.5 sec. and delay time of 457sec. which is about 88% of travel time is lost due to condition of traffic congestion on link (1). Also 238sec. total travel time for link (2) with delay time of 206sec. which is about 86% loss of travel time. And for link (3) a maximum travel time of 210 sec. and delay time of 172 sec. which is about 81.9% is lost due to delay congestion. GPS essentials equipped with cell phone is applied to compute the delay component (acceleration, deceleration and stopped delay) of signalized intersections at the selected site by determining the critical points for acceleration , deceleration and stopping then measure the required time, see Figure (2) of control points for each link. Since HCM used equation for estimate the control delay which is applied for fixed signalized signal during the day and this not achieved in our locally signalized intersection which almost managed by police man that organized the traffic movement at signalized intersections otherwise its produced error in the obtained results and not matching the reality conditions. Figures (8),(9) and (10) and tables (1), (2) and (3) presented the components of total delay for intersections in the selected site for ٣٠ sample run. It's clear that stopped delay compromise the major part of intersection delay for all links studied. Also the acceleration time delay is higher than deceleration time as shown in the obtained results due to the conflict vehicles in the intersection which make the driver more alert during passing the intersection and this take more time to accelerate.

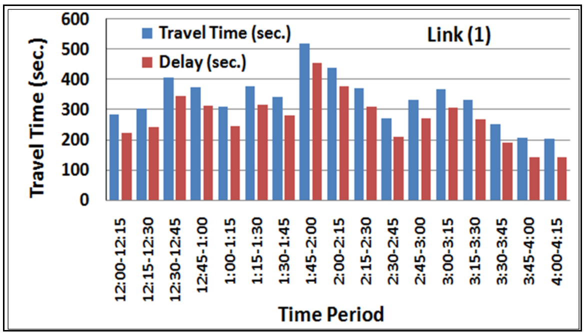


Fig. 3.Total Travel and Delay Time Variations During Peak period Time for Link (1).

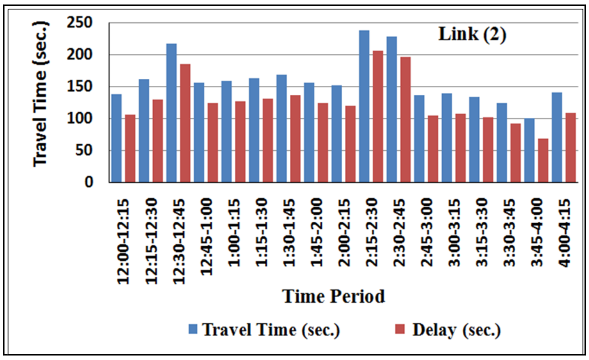


Fig. 4. Total Travel and Delay Time Variations During Peak Period Time for Link (2).

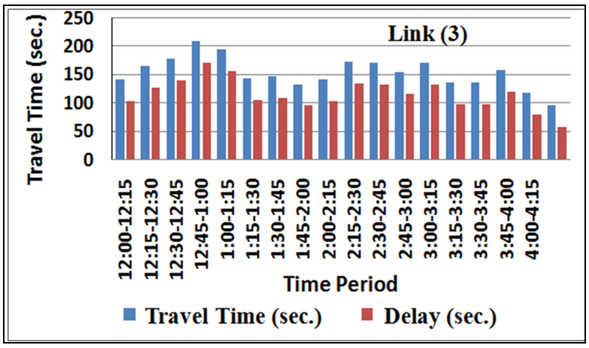


Fig. 5. Total Travel and Delay Time Variations During Peak period Time for Link (3).

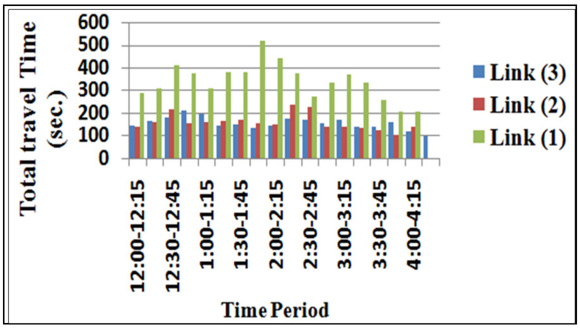


Fig. 6. Total Travel Time Variations During Peak period Time for Link (1), (2) and (3).

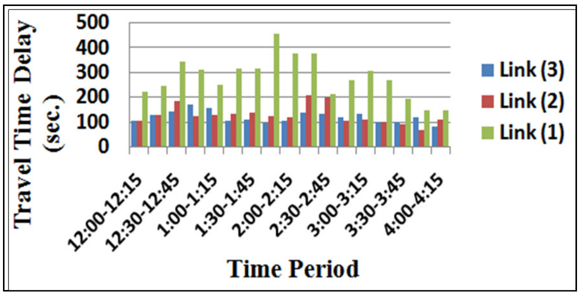


Fig. 7. Travel Time Delay Variations During Peak period Time for Link (1), (2) and (3).

Table 1,
Delay Component Results for Sample Run of Bab Al-Mutham Intersection.

Run No.	Deceleration Delay (sec.)	Acceleration Delay (sec.)	Stopped Delay (sec.)	Total Delay (sec.)
1	17	30	60	107
2	20	35	61	116
3	23	20	68	111
4	22	38	60	120
5	15	29	58	102
6	21	45	58	124
7	18	32	100	150
8	22	30	45	97
9	15	28	65	108
10	19	14	43	76
11	10	38	115	163
12	22	18	73	113
13	28	36	38	102
14	20	28	42	90
15	15	42	102	159
16	16	43	102	161
17	8	20	43	71
18	18	45	102	165
19	22	30	150	202
20	30	25	141	196
21	20	40	60	120
22	17	38	60	115
23	20	43	45	108
24	15	35	103	153
25	21	20	116	157
26	22	44	60	126
27	20	38	60	118
28	20	31	47	98
29	18	16	63	97
30	15	24	44	83

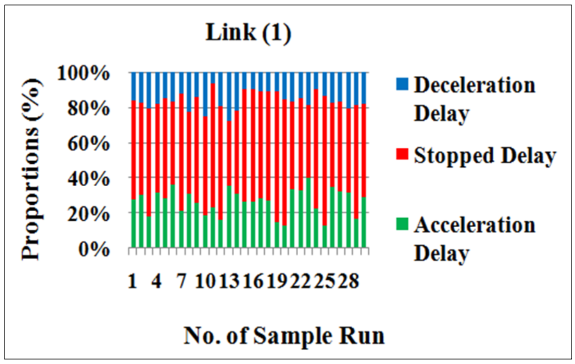


Fig. 8. Proportions of Total Delay at Intersection for Link (1).

Table 2,
Delay Component Results for Sample Run of Al-Sakara Intersection.

Run No.	Deceleration Delay (sec.)	Acceleration Delay (sec.)	Stopped Delay (sec.)	Total Delay (sec.)
1	10	14	55	79
2	12	18	74	104
3	16	30	53	99
4	20	30	59	109
5	15	34	48	97
6	30	45	120	195
7	10	25	58	93
8	13	31	48	92
9	35	30	55	120
10	17	42	46	105
11	20	40	71	131
12	22	38	60	120
13	10	39	75	124
14	25	35	58	118
15	35	30	45	110
16	15	33	50	98
17	12	28	43	83
18	30	41	60	131
19	12	43	53	108
20	31	44	105	180
21	18	43	106	167
22	15	40	54	109
23	30	15	46	91
24	35	26	50	111
25	15	33	35	83
26	14	28	38	80
27	10	40	33	83
28	10	40	50	100
29	15	22	37	74
30	25	33	51	109

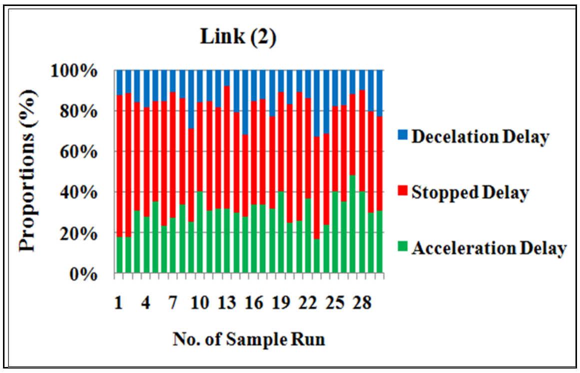


Fig. 9. Proportions of Total Delay at Intersection for Link (2).

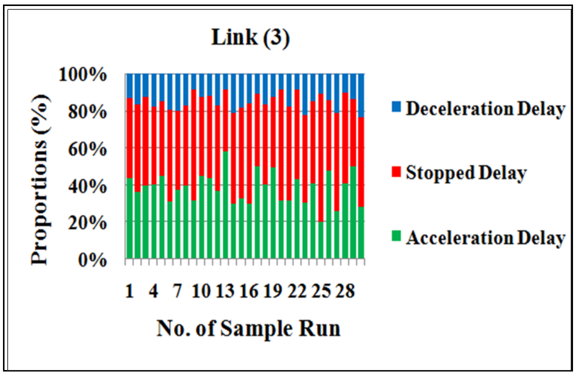


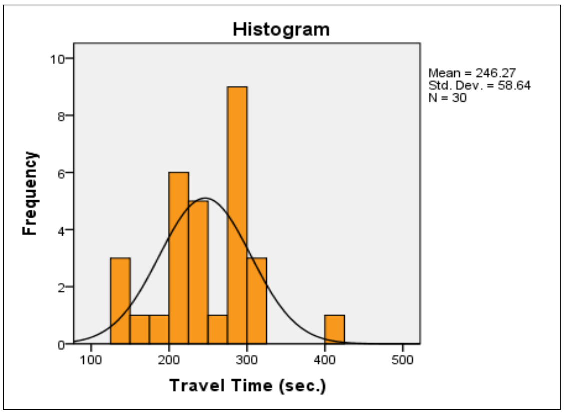
Fig. 10. Proportions of Total Delay at Intersection for Link (3).

Table 3,
Delay Component Results for Sample Run of Bairuit Intersection.

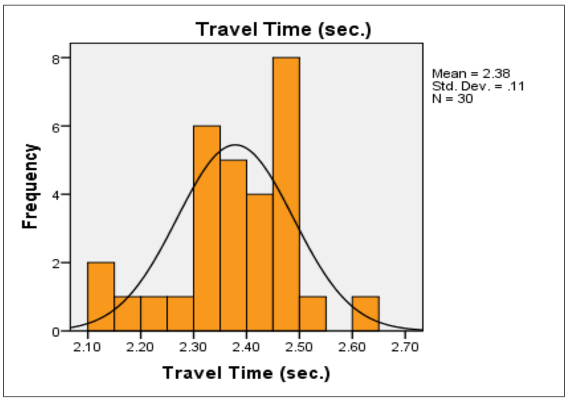
Run No.	Deceleration Delay (sec.)	Acceleration Delay (sec.)	Stopped Delay (sec.)	Total Delay (sec.)
1	12	40	40	92
2	20	43	55	118
3	16	50	60	126
4	21	48	50	119
5	20	60	53	133
6	30	47	75	152
7	38	70	80	188
8	24	55	60	139
9	13	48	91	152
10	18	65	62	145
11	12	44	45	101
12	14	30	37	81
13	10	70	40	120
14	25	35	58	118
15	17	30	45	92
16	15	28	50	93
17	12	55	43	110
18	23	56	60	139
19	18	70	53	141
20	15	56	105	176
21	25	44	70	139
22	10	49	54	113
23	22	30	46	98
24	20	55	60	135
25	15	28	95	138
26	14	47	38	99
27	18	22	45	85
28	10	39	46	95
29	14	50	36	100
30	25	30	51	106

4.2. Estimation of Travel Time Distribution

A 30 time data set of 15min. period is collected from field data using GPS essentials equipped with cell phone as explained earlier to study the behavior of travel time variation on the three links (1), (2) and (3) that provide significant variation and multimodal shape due to the delay at signalized intersection and impedance due to traffic jam at the selected links at peak period. A normal, lognormal distribution are applied and fitted for the field data using *(SPSS ver.21 statistical software)*. The graphical representation of histogram with normal curve for travel time distributions are shown in Figures(10) to (12) for Link (1), (2) and (3) in this research. The travel time distribution is fitted to normal for Link (1) and , log-normal for Link(2) and (3).Based on normality test for Shapiro-Wilk column in Tables (4) to (9) for Link (1) ,(2) and (3) respectively which illustrated the significant level of p -value greater than 0.05. See Table (10).



a) Normal Distribution



b) Log-normal Distribution

Fig. 10. Normal and Log-Normal Travel Time Distribution for Link (1).

Table 4,
Descriptive Statistics of Normal Distribution for Travel Time for Link (1).

			Statistic	Std. Error
Normal Distribution of Travel Time	Mean		246.27	10.706
	95% Confidence Interval for Mean	Lower Bound	224.37	
		Upper Bound	268.16	
	5% Trimmed Mean		245.26	
	Median		239.50	
	Variance		3438.685	
	Std. Deviation		58.640	
	Minimum		134	
	Maximum		403	
	Range		269	
	Interquartile Range		71	
	Skewness		.121	.427
	Kurtosis		.614	.833
Log-Normal Distribution of Travel Time	Mean		2.3786	.02006
	95% Confidence Interval for Mean	Lower Bound	2.3376	
		Upper Bound	2.4197	
	5% Trimmed Mean		2.3815	
	Median		2.3793	
	Variance		.012	
	Std. Deviation		.10987	
	Minimum		2.13	
	Maximum		2.61	
	Range		.48	
	Interquartile Range		.12	
	Skewness		-.634-	.427
	Kurtosis		.361	.833

Table 5,
Test of Normality for Travel Time Distribution for Link (1).

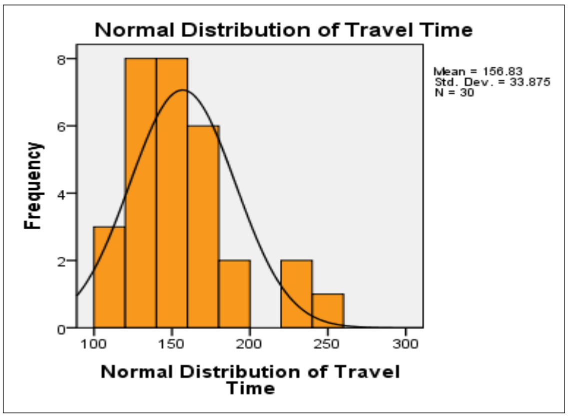
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Normal Distribution of Travel Time	.133	30	.184	.956	30	.247
Log- Normal Distribution of Travel Time	.153	30	.072	.937	30	.078

Table 6,
Descriptive Statistics of Normal Distribution for Travel Time for Link (2).

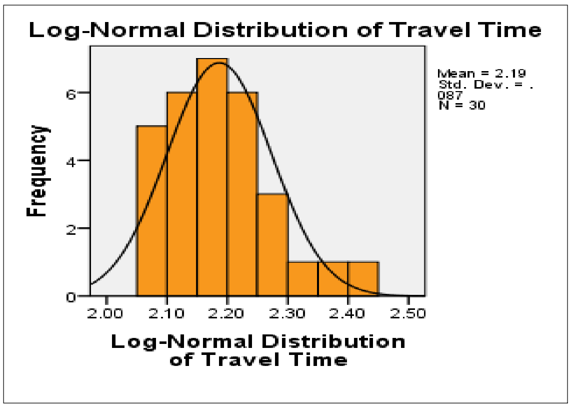
			Statistic	Std. Error
Normal Distribution of Travel Time	Mean		156.83	6.185
	95% Confidence Interval for Mean	Lower Bound	144.18	
		Upper Bound	169.48	
	5% Trimmed Mean		154.09	
	Median		151.00	
	Variance		1147.523	
	Std. Deviation		33.875	
	Minimum		116	
	Maximum		255	
	Range		139	
	Interquartile Range		38	
	Skewness		1.266	.427
	Kurtosis		1.727	.833
Log-Normal Distribution of Travel Time	Mean		2.1866	.01590
	95% Confidence Interval for Mean	Lower Bound	2.1541	
		Upper Bound	2.2191	
	5% Trimmed Mean		2.1820	
	Median		2.1789	
	Variance		.008	
	Std. Deviation		.08708	
	Minimum		2.06	
	Maximum		2.41	
	Range		.34	
	Interquartile Range		.11	
	Skewness		.725	.427
	Kurtosis		.425	.833

Table 7,
Test of Normality for Travel Time Distribution for Link (2).

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Normal Distribution of Travel Time	.118	30	.200*	.893	30	.006
Log-Normal Distribution of Travel Time	.083	30	.200*	.946	30	.134



a) Normal Distribution



b) Log- Normal Distribution

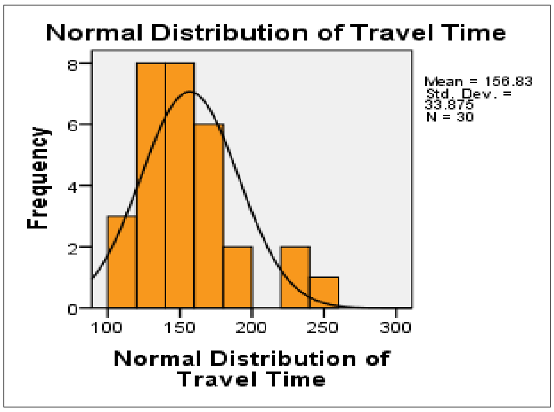
Fig. 11. Normal and Log-Normal Travel Time Distribution for Link (2).

Table 8,
Descriptive Statistics of Normal Distribution for Travel Time for Link (3).

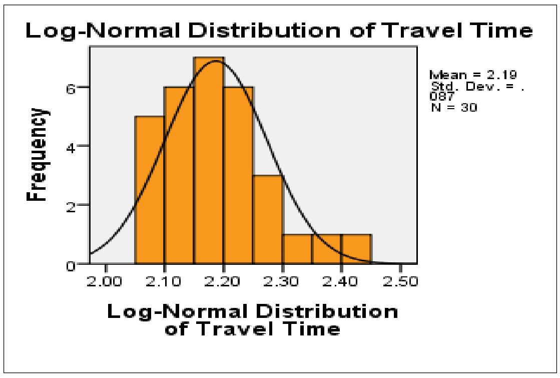
			Statistic	Std. Error
Normal Distribution of Travel Time	Mean		155.30	5.051
	95% Confidence Interval for Mean	Lower Bound	144.97	
		Upper Bound	165.63	
	5% Trimmed Mean		153.93	
	Median		152.50	
	Variance		765.459	
	Std. Deviation		27.667	
	Minimum		119	
	Maximum		216	
	Range		97	
	Interquartile Range		43	
	Skewness		.602	.427
	Kurtosis		-.406-	.833
Log-Normal Distribution of Travel Time	Mean		2.1847	.01378
	95% Confidence Interval for Mean	Lower Bound	2.1566	
		Upper Bound	2.2129	
	5% Trimmed Mean		2.1824	
	Median		2.1832	
	Variance		.006	
	Std. Deviation		.07547	
	Minimum		2.08	
	Maximum		2.33	
	Range		.26	
	Interquartile Range		.12	
	Skewness		.323	.427
	Kurtosis		-.885-	.833

Table 9,
Test of Normality for Travel Time Distribution for Link (3).

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Normal Distribution of Travel Time	.146	30	.102	.930	30	.050
Log-Normal Distribution of Travel Time	.144	30	.113	.945	30	.125



a) Normal Distribution



b) Log- Normal Distribution

Fig. 12. Normal and Log-Normal Travel Time Distribution for Link (3).

Table 6,
Test Statistics for Travel Time Distribution.

Link	Type of Distribution	Test Statistics Significant
1	Normal	0.247
	Log-Normal	0.078
2	Normal	0.006
	Log-Normal	0.134
3	Normal	0.05
	Log-Normal	0.125

4.3. Travel Time Model

Different predicted model for the three studied links of Palestine street have been made based on the obtained field data as shown below:

Travel Time for Link (1):

$$TT = 1.012DT + 67.87$$
$$R = 0.939 \quad R^2 = 0.882$$

Travel Time for Link (2):

$$TT = 1.148DT + 30.464$$
$$R = 0.967 \quad R^2 = 0.936$$

Travel Time for Link (3):

$$TT = 1.028DT + 30.432$$
$$R = 0.985 \quad R^2 = 0.970$$

Where: TT: Total Travel Time (sec.)
DT: Delay Time at signalized Intersection (sec.)
The summary of stepwise regression linear models are displayed in Tables (7) to (9) respectively for Link (1), link (2) and link (3).

Table 7,
Stepwise Regression Models Summary for Travel Time of Link (1).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	67.870	17.651		3.845	.001
	Delay at Intersection (sec.)	1.012	.070	.939	14.500	.000

Table 8,
Stepwise Regression Models Summary for Travel Time of Link (2).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	30.464	6.461		4.715	.000
	Delay at Intersection (sec.)	1.148	.057	.967	20.186	.000

Table 9,
Stepwise Regression Models Summary for Travel Time of Link (3).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
3	(Constant)	30.432	4.268		7.130	.000
	Delay at Intersection (sec.)	1.028	.034	.985	29.922	.000

The validation of the three travel time model have been illustrated in Figures (13) to (15) between the estimated travel time and observed travel time from field data. An additional data have been measured and not included in the model building to complete the process of validations.

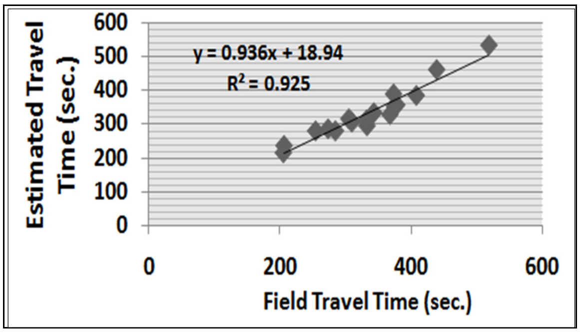


Fig. 13. Predicted Travel Time Model Versus Field Travel Time for Link (1).

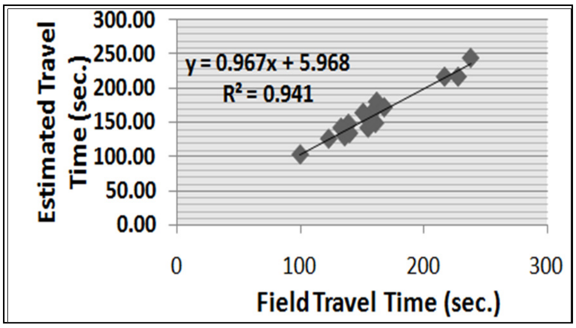


Fig. 14. Predicted Travel Time Model Versus Field Travel Time for Link (2).

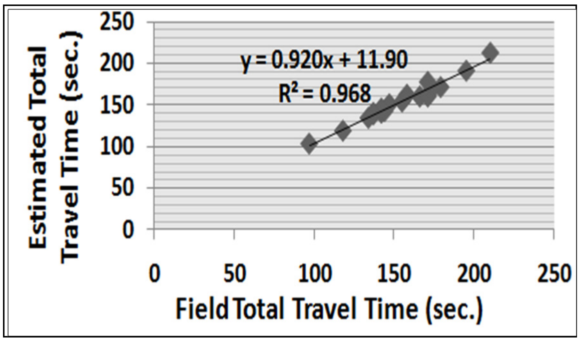


Fig. 15. Predicted Travel Time Model Versus Field Travel Time for Link (3).

A best fit is presented as compared the predicted model with the observed field travel time data for all the models of studied links which illustrated that the predicted model can present the actual field data. The goodness of fit for predicted model and field observed data have been checked using chi-square test as shown in Tables (10) to (12) for the study links.

Goodness of Fit:
Chi-Square Test
N=17 df=16 significant level α =0.05

Predicted Models	χ^2	$\chi_{critical}$
Link(1)	24.71978	26.296
Link(2)	8.02577	26.296
Link (3)	2.719857	26.296

For $\chi^2 < \chi_{critical}$; there are no significant difference between predicted model and observed field data.

4.4. Reliability Measurement

The variability of travel time effect on its reliability measurement and then produced extra arrival time which had a real cost. Furthermore reliability of travel time is an important topics for increasing safety, quality life for road users, to produce less delay for their trips. Also it's a good indicators for improving the overall system operations and management. Buffer time reliability measure is explained as [9]:

$$\textbf{Buffer Index}\ (\%) = \frac{\textbf{95th percentile Travel Time (sec.)} - \textbf{Average Travel Time(sec.)}}{\textbf{Average Travel Time (sec.)}} \quad ...(1)$$

Figure (15) presented the reliability measurement for Palestine arterial street interms of the buffer time index for link (1), (2) and (3). Increasing the buffer time index results in worse reliability conditions. Link (2) produced a buffer index of about 36% and 26 % for Link (1) and finally for link (3) which present a 24% buffer index. These illustrated that the reliability get worst for link (2) (1) and (3) respectively. Also buffer time of (62 , 59, and 38) sec. for Link(1, 2and 3) respectively is obtained based on average travel time for each link, that mean additional 62, 59 and 38 sec. buffer time is provided from the average value to ensure 95% arrive on time at the destination of arterial corridor for link (1),(2) and (3). Also Figure (16) show the 95% percentile travel time for observed links which presents the extra delay that perceived on each link (301.9, 219.4, and 193.8)sec. for Link (1, 2 and 3) respectively. Higher value for 95% travel time is obtained for link (1). Figure (17) illustrated the travel time index which represent the average travel time divided by free flow time for the roadway study segments. A 4.2 %, 4.9% and 4% TTI is obtained for Link (1, 2 and 3) respectively. Increasing the Travel time index

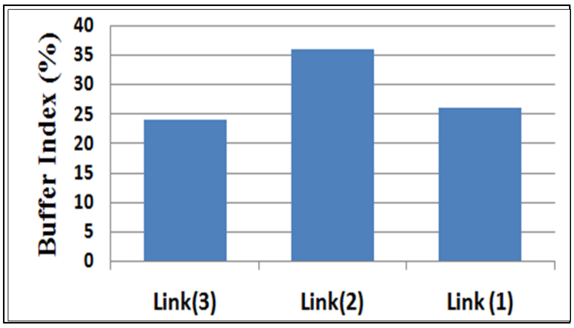


Fig. 15. Buffer Time Index for Link (1), (2) and (3).

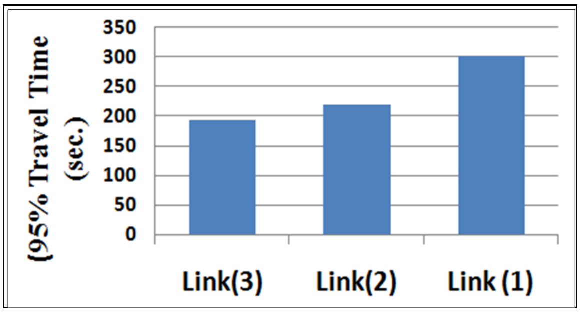


Fig. 16. 95% Percentile Travel Time Results for Link (1), (2) and (3).

Greater than 1.0 meaning taking a longer travel time by about 420, 490 and 400 percent of free travel time to travel the three segment length respectively with the higher travel time index for Link(2) and link(1) and finally with link(3). This demonstrated the heavily congested conditions. Also Figure (18) prove the above statement interms of estimating the delay per travelling kilometer for each segment length (1.03, 0.520, and 0.620) Km for link (1, 2 and 3) respectively studied in this research. Figure (17) depicted the maximum value for delay per km that obtained for link(1) which is about 266 sec/km and 268 sec./km for (3) and 244 sec/km for link (2).

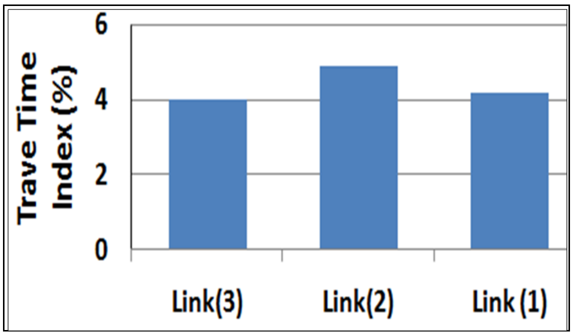


Fig. 17. Travel Time Index Results for Link (1), (2) and (3).

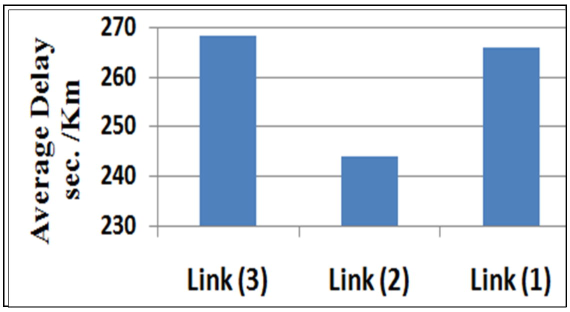


Fig. 18. Average Delay per Kilometer Results for Link (1), (2) and (3).

5. Conclusions

It can be drawn the following points:

1. Maximum travel time of 518.5 sec. and delay time of 457sec. which is about 88% of travel time for link (1); also 238sec. total travel time for link (2) with delay time of 206sec. which is about 86% loss of travel time. For link (3) a maximum travel time of 210 sec. and delay time of 172 sec. which is about 81.9% is lost due to delay congestion.
2. Stopped delay compromise the major part of intersection delay for all links studied. Also the acceleration time delay is higher than deceleration time due to the conflict vehicles in the intersection.
3. Buffer time index results in worse reliability conditions. Link (2) produced a buffer index of about 36% and 26 % for Link (1) and finally for link (3) which presented a 24% buffer index.
4. The 95% percentile travel time of about (301.9, 219.4, and 193.8) sec. for Link (1, 2 and 3) respectively. Higher value for 95% travel time is obtained for link (1).
5. Travel time index TTI of 4.2 %, 4.9% and 4% is obtained for Link (1, 2 and 3) respectively. Higher travel time index for Link (2) and link (1) and finally with link (3) respectively.
6. Maximum value for delay per km that obtained for link(1) which is about 266 sec/km and 268 sec./km for (3) and 244 sec/km for link(2).

6. Refrences

[1] Richardson A. J. and Taylor, M.A.P. (1978):" Travel time variability on commuter journeys". *High Speed Ground Transportation Journal.* 6. pp. 77–79.

[2] Rakha, H., El-Shawarby, I., M. Arafeh & Dion, F. (2006):" Estimating Path Travel-Time Reliability". *Proceedings of the IEEE* -ITSC 2006. Toronto, Canada. September 17-20.

[3] Arezoumandi, M. (2011):"Estimation of Travel Time Reliability for Freeways Using Mean and Standard Deviation of Travel Time". Journal of transp. Syst. Engineering and info. Tech. Volume 11. Issue 6.

[4] Pu, W. (2010): "Analytic relationships between travel time reliability measures. Compendium of Papers TRB". 90th Annual Meeting. Washington, D.C., USA.

[5] Polus, A. (1979): "A study of travel time and reliability on arterial routes. Transportation". 8. pp. 141–151.

[6] Al-Deek, H. & Emam, E.B. (2006): "New methodology for estimating reliability in transportation networks with degraded link capacities". Journal of Intelligent Transportation Systems. pp. 117–129.

[7] Taylor, M. & Susilawati, S. (2012):" Modeling travel time reliability with the Burr distribution". Procedia - Social and Behavioral Sciences. Volume 54. 4 October 2012. pp. 75–83.

[8] Susilawati, S., Taylor, M.A.P. & Somenahalli, S.V.C. (2012):" Distributions of travel time variability on urban roads". Journal of Advanced

[9] Federal Highway Administration. (2005):" Traffic congestion and reliability: Trends and advanced strategies for congestion mitigation". Cambridge Systematic Inc. and Texas Transportation Institute, College Station, TX.

[10] Chen, C., Skabardonis, A., and Varaiya, P. (2003). “Travel Time Reliability as a Measure of Service.” In Transportation Research Record: Journal of the Transportation Research Board, 1855, pp. 74–79.

نماذج التنبؤ لزمن الرحلة ومؤشرات الوثوقية لشارع فلسطين شرياني حضري في مدينة بغداد

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الخلاصة

حساب زمن الرحلة وحسابات الوثوقية هي عوامل مهمة لتحسين كفاءة التشغيل والأمان للشبكة المرورية ولتوزيع أفضل لرحلات تخطيط النقل. الهدف من هذا البحث هو حساب زمن الرحلة الكلي وتحليل التوزيع لزمن الرحلة لثلاثة مقاطع مختارة من شارع فلسطين الشرياني في مدينة بغداد والذي يعد واحد من الشوارع المهمة التي تمر في المناطق السكنية والتجارية في مدينة بغداد نتيجة التطور السريع الحاصل في استعمالات الأرض والذي يولد ضغط إضافي لتوليد وجذب الرحلات اليومية.

أعلى قيمة لزمن الرحلة ٥١٨,٥ ثانية وزمن التأخير ٤٥٧ ثانية حيث يتم ضياع ٨٨% من زمن الرحلة بسبب طبيعة زدحام المرور في المقطع رقم ١. وزمن الرحلة المستغرق للمقطع رقم ٢ ,٢٣٨ ثانية وزمن تأخير بحدود ٢٠٦ ثانية أي يتم ضياع من الوقت بحوالي ٨٦% بوصفه تأخيراً . وبالنسبة للمقطع رقم ٣ أعلى زمن رحلة مستغرق هو ١٧٢ ثانية ويمثل حوالي ٨١,٩% ضياع بالوقت بسبب تأخير الزدحام. زمن Buffer٦٢, ٥٩, ٣٨ تم الحصول عليه بالنسبة للمقطع رقم ١,٢,٣ على التوالي. هذا يعني وقتاً إضافياً بحدود ٦٢.,٥٩,٣٨ لكل من المقطع ١,٢,٣ على التوالي من معدل زمن الرحلة للحصول على دقة ٩٥% للوصول غاية الرحلة في نهاية الطريق الشرياني. نتائج مؤشرات زمن Buffer أظهرت سوء الوثوقية. المقطع رقم ٢ من باب المعظم إلي تقاطع الصخرة أعطى ٣٦% مؤشر وثوقية و٢٦% مؤشر وثوقية بالنسبة لمقطع رقم ١ من تقاطع الموال إلى تقاطع باب المعظم وأخيرا ٢٤$ مؤشر وثوقية من تقاطع الصخرة إلى تقاطع ساحة بيروت. هذه النتائج تدل على سوء مؤشرات الوثوقية لمقطع رقم ١,٢,٣ على التوالي. زمن تأخير إضافي بحدود ٣٠١, ٢١٩,٤, ١٩٣,٨ ثانية للمقطع رقم ١,٢,٣ على التوالي. تم الحصول على أعلى قيمة ل ٩٥% زمن الرحلة للمقطع رقم ١. تم الحصول من النتائج على مؤشر زمن الرحلة حوالي ٤,٢ ,٤,٩, و ٤% للمقطع رقم ١,٢,٣ على التوالي. زيادة مؤشر زمن الرحلة اكبر من ١,٠ يدل على استغراق وقت إضافي للرحلة عن الوقت الحر المثالي للمقاطع الثلاثة المدروسة مع اعلى مؤشر زمن رحلة للمقطع ١ رقم و مقطع رقم ٢ وأخيرا للمقطع رقم ٣. اعلى قيمة لنتائج التأخير لكل كم طول كانت للمقطع رقم ١ بحوالي ٢٦٦ثانية /كلم و ٢٦٨ كلم /ثانية للمقطع رقم ٣ و ٢٤٤ ثانية /كلم للمقطع رقم ٢ . أيضا تم تطوير نماذج التنبؤ لزمن الرحلة للمقاطع الثلاثة في منطقة الدراسة لشارع فلسطين اعتمادا على البيانات الحقلية المستحصلة. تم الحصول على توافق جيد عند مقارنة النماذج مع البيانات الحقلية لزمن الرحلة مما يبين قابلية تمثيل االنماذج للبيانات الحقلية.