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Proposed Methodology to Investigate the Metro Operation, Socio-Economic Impact, and its Revenue Using Automatic Ticket Machine Outputs

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Abstract: Automatic Ticket Machine outputs give the daily passengers' traffic which entry from any station to exit to all stations in alphabetic arrangements. To utilize these important data for analyzing the phenomena and concluding the important predicted recommendations, a methodology was proposed within the present research paper. This method has the advantage to determine the O-D matrix for the metro passengers using its networks. The proposed methodology can be applicable to analyze, investigate, and predict the metro passenger traffic under different scenarios. To make Automatic Ticket Machine outputs in practices change the Entry- Exit Matrix from alphabetic arrangements into arranged Entry- Exit Matrix according to successive stations. The obtained results concluded the actual operation system on the platform, within the metro doors and into metro cars. In addition to investigate the socio-economic impact for metro stations finally, the corresponding revenue by applying different scenarios for every zone can be predicted.

Keywords: Automatic Ticket Machine; Revenue; Socio-Economic Impact; Metro Operation; passenger intensity.

I. INTRODUCTION

There are many methods to determine and observing a crowded spatial scene and detecting and tracking the motion of any moving object in the scene such as people, animals, or vehicles. Examples of such environments are shopping malls or concourses in airports or railway stations where hundreds of objects move around. To travel through such an environment any object must be identified and his motion must be tracked in order to discover and avoid potential collisions.[1] The problem becomes more difficult, when the sensor is not stationary but also moves around while observing the environment. The motion detection and tracking problem is studied in the context of a research project which is concerned with the development of guidance for an intelligent wheelchair MAid [2]. This guidance system should enable the wheelchair to maneuver autonomously in a shopping mall or a railway station and cross an area with many moving people. E. Prassler, et, al [3]. Proposed a method for detecting and tracking the motion of a large number of moving objects in crowded environments, such as concourses in railway stations or airports Unlike many methods for motion detection and tracking, the 2D range images were used from a laser rangefinder to achieve the real-time capability of this approach. The time-variance of an environment is captured by a sequence of temporal maps, which was denoted as time stamp maps. A time stamp map is a projection of a range image onto a two dimensional grid, where each cell which coincides with a specific range value was assigned a time stamp. Based on this representation the two very simple algorithms for motion detection and motion tracking were obtained. The approach was successfully applied to a set of range images recorded in the waiting hall of a train station during the morning rush-hour.

Katsuyuki NAKAMURA, et, al [4]. Studied the feasibility for analyzing and visualizing passenger flows using laser scanners in a railway station. A network of laser scanners is located on different places and scan pedestrian's feet at a horizontal plane above the ground. Motion trajectories are extracted from the laser points on moving feet. Thus it can find the pattern of passenger flows and its change with time. Through three experiments in railway stations, it was concluded that the proposed method is efficient in examining user behavior even in the crowded stations.

Mai M El Deeb et, al [5]. Studied the optimal operation interaction for GCUM 1st and 2nd lines by proposing a methodology based on field survey of travel time, passenger waiting time, actual headway, alighting and boarding passengers to determine the actual passenger intensity on platform, passenger intensity into train and headway, to determine the ideal operation and the minimum operational costs. Using four alternatives (divide the line into definite links, change headway, overflow of some through stations and uses of suitable metro units) under 5 restrictions (Passenger intensity into train, Passenger exchange time at metro door, Passenger intensity on platform, headway at the end of links and Factor of safety for metro headway) and without any additional capital costs, the results show a lowest cost for both rolling stock capital costs and operation costs.

Many engineering consultant [6], [7] studied the passenger traffic fluctuation at railway stations, determined their needs and suggested the improvement.

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II. PROPOSED METHODOLOGY

Within the following steps, the Automatic Ticket Machine (ATM) inputs can be applicable to analyze, investigate, and predict the metro passenger traffic under different scenarios.

a) Entry- Exit Matrix obtained by Automatic ticket machine (ATM) in alphabetic arrangements, as shown in figure (1)

Exit	ABBASSIA	ABDOU PASHA	AIN HELWAN	AIN SHAMS
AIN HELWAN	67	50	574	206
AIN SHAMS	58	132	113	1032
AL SHOADAA	113	91	859	6161
DAR EL-SALAM	490	247	756	545
EL MAADI	252	180	1234	1613
EL-DEMERDASH	12	12	103	4073
EL-MALEK EL-SALEH	122	70	619	787
EL-MARG	0	0	0	0
EL-ZAHRAA	170	130	427	773
EZBET EL-NAKHL	103	276	221	2076

Figure (1) an example of a part of Entry- Exit Matrix obtained by Automatic Ticket Machine (ATM)

b) Rearrange the Entry- Exit Matrix according to successive stations for first, second, and third lines respectively. Figure (2) shows an example of a part of the re-arranged stations.

			1	2	3	4	5
			HELWAN	AIN HELWAN	WADI HOF	HADAYEQ HELWAN	MAASARA
			S	S	S	S	S
1	S	HELWAN	2278	607	1795	4186	4795
2	S	AIN HELWAN	643	574	269	823	1085
3	S	WADI HOF	1774	290	449	391	425
4	S	HADAYEQ HELWAN	4524	965	571	761	1714
5	S	MAASARA	6866	1159	830	3050	1740
6	S	TURA EL ASMENT	372	94	19	161	226
7	S	KOZZIKA	1951	271	228	1022	1241
8	S	TURA EL-BALAD	1046	228	101	473	350

Figure (2) an example of a part of the re-arranged stations

c) Ignore the internal traffic within any station as its users are not considered as metro passengers,

Consequently, all the diagonal entry- exit matrix elements becomes zeros and the total entry and exit passengers must be reduced by this values, as shown in figure(3)

		1	2	53	3	4	5
		HELWAN	AIN HELWAN	HELWAN UNIVERSITY	WADI HOF	HADAYEQ HELWAN	MAASARA
1	HELWAN	0	607	422	91	427	425
2	AIN HELWAN	643	0	163	269	823	1085
53	HELWAN UNIVERSITY	403	91	0	10	144	125
3	WADI HOF	1774	290	137	0	391	425
4	HADAYEQ HELWAN	161	2	24	19	0	38
5	MAASARA	6866	1159	468	830	3050	0

Figure (3) O-D Passenger ignoring the internal traffic within any station as its users are not considered as metro passengers

d) replace the zero diagonal entry- exit matrix elements by the sum of the entry passengers at any station as shown in figure (4)

		1	2	53	3	4	5
		HELWAN	AIN HELWAN	HELWAN UNIVERSITY	WADI HOF	HADAYEQ HELWAN	MAASARA
1	HELWAN	92490	607	422	91	427	425
2	AIN HELWAN	91847	14285	586	360	1250	1510
53	HELWAN UNIVERSITY	91444	13678	19829	370	1394	1634
3	WADI HOF	89670	13587	19243	11034	1786	2059
4	HADAYEQ HELWAN	89509	13297	19106	10665	37391	2098
5	MAASARA	82643	13294	19082	10645	35606	31246

Figure (4) replace the zero diagonals for any station by the sum of entry passengers

e) Estimate the non-records values for the stations which their automatic ticket machine outputs had no records by the aid of the actual field data on 2017 as shown in figure (5a, 5b) respectively.

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	HELWAN	AIN HELWAN	WADI HOF	HADAYEQ HELWAN	MAASARA	TURA EL ASMENT
	S	S	S	S	S	S
MAZALL AT	259	28	24	39	30	5
KALAFA WY	0	0	0	0	0	0
ST.THER ESA	0	0	0	0	0	0
ROD EL-FARG	0	0	0	0	0	0
MASARR A	0	0	0	0	0	0

Figure (5.a) a sample of non-record values for some stations in the 2nd line.

	HELWAN	AIN HELWAN	WADI HOF	HADAYEQ HELWAN	MAASARA	TURA EL ASMENT
	S	S	S	S	S	S
MAZALL AT	259	28	24	39	30	5
KALAFA WY	75	9	7	30	21	1
ST.THER ESA	14	2	1	6	4	0
ROD EL-FARG	232	27	21	94	64	2

Figure (5.b) a sample of assumed values for some stations having no records in the 2nd line.

f) Calculate the passengers' intensity on the waiting platform zone for each station, table (1) gives an example for waiting passenger intensity at the up direction and the down one.

Table 1 an example for waiting passenger intensity for up and down directions

	1	2	53	3		
	Helwan	Ain Helwan	Helwan University	Wadi Hof	*waiting passenger up/m2	*waiting passenger down /m2
Ghamra	2414	281	732	166	0.315	0.299
El-Demerdash	888	103	101	48	0.224	0.293
Manshiet El-Sadr	478	31	96	48	0.138	0.223
Kobri El-Kobba	2119	149	576	175	0.309	0.311
Hammamat El-Kobba	1032	110	379	79	0.076	0.055

waiting passenger intensity /m2 = (boarding passenger/train) / (waiting zone width *platform length).

Waiting zone equals 2.5 m for all lines; the platform length equals 200 m for 1st line and equals 180m for 2nd and 3rd lines.

g) Calculate the minimum passengers' exchange time at each station table (2) gives an example to estimate the minimum stop time for each station.

Table (2) an example to estimate the minimum stop time for each station

	1	2	53	3		
	Helwan	Ain Helwan	Helwan University	Wadi Hof	t stop / Helwan	t stop/ Marg
GHAMRA	2414	281	732	166	8.79	8.37
EL-DEMERDASH	888	103	101	48	7.17	6.79
MANSHIET EL-SADR	478	31	96	48	5.69	5.89
KOBRI EL-KOBBA	2119	149	576	175	8.82	8.36
HAMMAMAT EL-KOBBA	1032	110	379	79	7.01	5.83

t stop (sec.) = (1.5 opening door + ((Alighting + Boarding passenger) * 0.5) / (4 doors / car * n cars /train)+1.5 closing door)

Where:

n= 9 cars for 1st line, and 8 for 2nd and 3rd lines.

h) Calculate the passengers' intensity into cars as shown in table (3).

Table (3) passenger intensity into cars

		HELWAN	AIN HELWAN	HELWAN UNIVERSITY	WADI HOF	passenger intensity / m^2
27	SARAY EL-KOBBA	9355	1465	3448	1674	2.2
28	HADAYEK EL-ZEITOUN	7470	1443	3392	1657	2.09
29	HELMIET EL-ZEITOUN	6521	1041	3154	1419	2
30	MATARIA	6073	788	1671	671	1.95

Passenger /day= [trips at off peak * cars/ train (seats + (standing area m2 * passenger intensity / m2 at off peak)] + [trips at peak * cars/ train (seats + (standing area m2 * passenger intensity /m2 at peak)] as shown in table (4).

Where;

Trips at off peak = 46 trains/ day

Trips at peak = 194 trains/ day.

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Table (4) technical characteristics for the greater Cairo metro for the three lines.

Line	units/train	Cars/unit	Unit 1, 2	Unit 3	Standing area (m²)		Seats	Elec. system
					Motor	*Trailer*		
1st	3	3	MC – T – M	MC – T- MC	33.93	34.7	48	Overhead
2nd	2	4	MC – N1 – T – N2		26.68	27.44	32	Third rail

III. APPLICATIONS

Table (5) summarizes the operating time for the 3 lines during a working hours/ day and the corresponding trip/direction. To obtain the maximum passengers on peak hours, the following equation can be used:

$$x = \frac{H_{om} * N_{om} + H_p * N_p + H_{on} * N_{on}}{H_p * N_p}$$

Where:

x = ratio between passenger at peak hours and the average passenger within daily working hours.

H_{om}= headway at off peak morning

H_p = headway at peak hours.

H_{on}= headway at off peak night

N_{om} = trips at off peak morning

N_p = trips at peak hours.

N_{on} = trips at off peak night.

Table (5) the operating time for the 3 lines and the corresponding trip/direction

		off peak		peak		off peak		Total trip/ direction.
line 1		from	to	from	to	from	to	240
	departure time	5.15	5.35	5.4	18.55	19	24	
	trips/ direction	3		194		43		
line 2		from	to	from	to	from	to	332
	departure time	5.15	6.00	6.05	23.45	23.50	24.30	
	trips/ direction	5		321		6		
line 3		from	to	from	to	from	to	209
	departure time	5.15	6.32	6.37	21.28	21.33	24.43	
	trips/ direction	8		178		23		

A. Check the train operation.

Waiting passenger intensity on the platform Zone:

From table (1), one can draw up the relation between the boarding intensity in passengers / meters square of the waiting zone on the platform at peak hours for all stations as shown in figure (6)

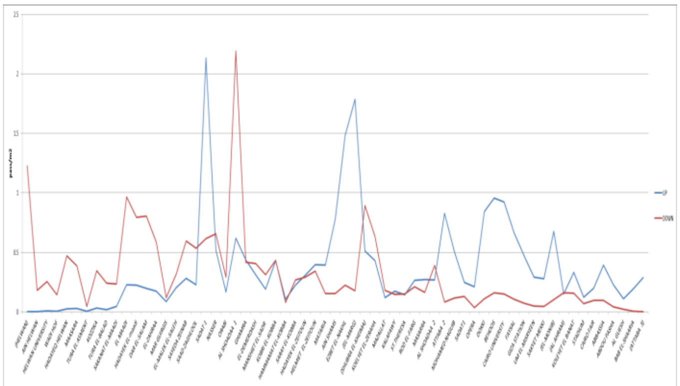

Figure (6) boarding passenger intensity on the platform at the peak hour for all stations

a) Passengers' Exchange Time

From table (2), one can draw up the Passengers' Exchange Time at peak hours for all stations as shown in figure (7)

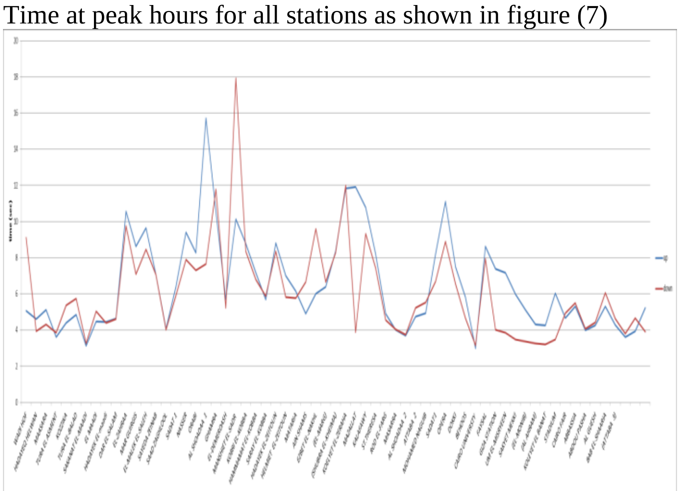

Figure (7) the Passengers' Exchange Time at peak hours for all stations

b) Intensity into Cars

From table (3), one can draw up the Passengers intensity at peak hours for the 1st, 2nd, and 3rd lines as shown in figure (8.a), (8.b) and (8.c) respectively

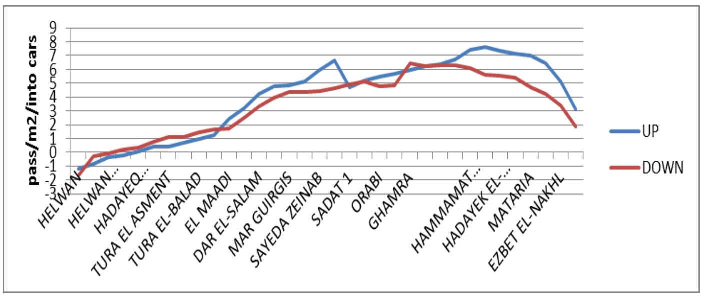

Figure (8.a) Passengers intensity at peak hours for the 1st line.

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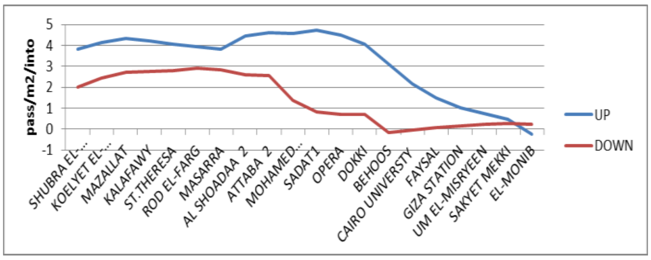

Figure (8.b) Passengers intensity at peak hours for the 2nd line.

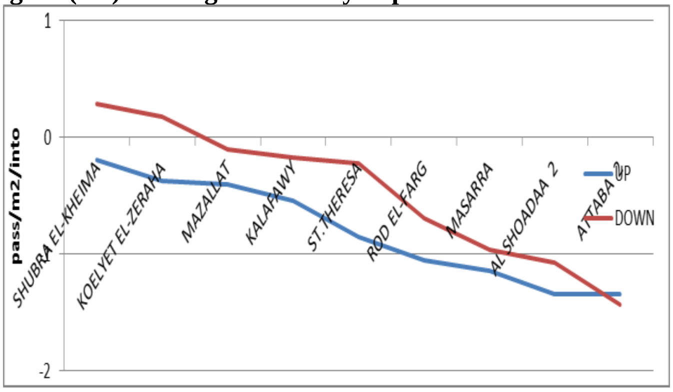

Figure (8.c) Passengers intensity at peak hours for the 3rd line.

c) Investigate the socio-economic impact for metro stations.

Despite of ticket price increase since July 2018, the metro network is still the preferable mode of transport due to applying the intelligent card and three-month tickets. The metro represents the most rapid public transport especially for long trips, so the metro passenger users who travel for a long and short distance are still using it while passengers for medium distance left it. Table (6) gives the decrease rate of the passengers for 2017 to 2018.

Table (6) decrease rate of the passengers for 2017 to 2018

		1st line		2nd line		3rd line	
		passengers * 10^6	revenue * 10^6	passengers * 10^6	revenue * 10^6	passengers * 10^6	revenue *10^6
1st zone (3L.E)	UP	0.59	1.76	0.27	0.81	0.05	0.16
	DOWN	0.43	1.30	0.18	0.53	0.05	0.14
2nd zone (5L.E)	UP	0.30	1.48	0.12	0.60	0.03	0.16
	DOWN	0.20	0.99	0.05	0.26	0.00	0.00
3rd zone (7L.E)	UP	0.10	0.72	0.23	1.58	0.06	0.40
	DOWN	0.29	2.01	0.04	0.28	0.00	0.00

Table (7.a) the actual passengers and corresponding revenue for the 3 zones.

		1st line		2nd line		3rd line	
		passengers * 10^6	revenue * 10^6	passengers * 10^6	revenue * 10^6	passengers * 10^6	revenue *10^6
1st zone (3L.E)	UP	0.67	2.00	0.27	0.81	0.05	0.16
	DOWN	0.49	1.47	0.18	0.53	0.05	0.14
2nd zone (5L.E)	UP	0.25	1.27	0.10	0.51	0.03	0.14
	DOWN	0.17	0.85	0.05	0.26	0.00	0.00
3rd zone (7L.E)	UP	0.10	0.72	0.23	1.58	0.06	0.40
	DOWN	0.29	2.01	0.04	0.28	0.00	0.00

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Table (7.b) the expected passengers and corresponding revenue for the 3 zones

	2017	2018	decreasing rate		
February	68981369	68004294	-1%	2nd semester	
March	81208101	77276325	-5%		
April	69598879	72607394	4%		
May	71216107	65347177	-9%		
June	57401297	54764265	-5%		
July	63611194	56988257	-12%	Summer vacancy	
August	62817941	51738279	-21%		
September	59542343	55231783	-8%	1st semester	
October	73887863	66312286	-11%		
November	72938537	64397428	-13%		
December	74009603	65343072	-13%		
January	73845988	69003077	-7%	1st semester	Winter vacancy

d) Estimate the daily revenue.

Table (7.a) gives the actual passengers for the three zones in up and down directions and the corresponding revenue

- Sensitivity study:

Applying the sensitivity study to determine the effect of changing station zones to be 10 stations instead of 9 for zone 1 and 6 stations for zone 2. assume that 1/7 passengers of the 2nd zone up direction (=0.04) will be as passengers of the first zone. These passengers will be increased by .59*106 / .3*106 = 1.97, thus the attractive traffic to the first zone become = .59+0.04*1.97= .67 passengers.

% Revenue increase = (3.27-3.24)/3.24= .93%

Assume that 1/7 passengers of the 2nd zone down direction (=0.028) will be as passengers of the first zone. These passengers will be increased by 0.3*106 / 0.1*106 =3, thus the attractive traffic to the first zone become = 0.43 *106 +0.028*3= .49 *106 passengers.

% Revenue increase = (3.32-3.29)/3.29= 0.91%.

Table (7.b) summarize the expected passengers and corresponding revenue for the 3 zones assuming that the 1st zone has 10 stations instead of 9 stations

Table (7.a) the actual passengers and corresponding revenue for the 3 zones.

Table (7.b) the expected passengers and corresponding revenue for the 3 zones

IV. CONCLUSION

Automatic Ticket Machine outputs give the daily passengers' traffic which entry from any station (column) to exit to all stations (row) in alphabetic arrangements. To utilize these important data for analyzing the phenomena and concluding the important predicted recommendations, a methodology was proposed within the present research paper. The obtained results concluded the actual operation system on the platform, within the metro doors and into metro cars.

a) Waiting passenger intensity on the platform Zone

Referring to table (1) and figure (7) the average passenger on the up and down platform was found 0.33 and 0.29 pass/m2 respectively. Despite the passenger intensity on the platform was around the permissible specifications. There was some high intensity on Alshohadaa and Elsadat platform for the 1st line. Duo to the passenger behavior who doesn't respect the waiting zone width and not gathering uniformly along the train length, so an apparent high passenger density on the platform was recorded.

b) Passengers' Exchange Time

Referring to table (2) and figure (8) an average stop time = 8.5, and 7.89 sec. for up and down direction respectively, except in Alshohadaa on the down direction and Elsadat for up direction which had 14, 21 sec respectively.

c) Intensity into Cars

Referring to table (3) and figures (9.a), (9.b), (9.c)

- For 1st line: passenger intensity into cars was less than 2 pass/m2 from Maadi to Helwan in the both directions up and down, then on the up direction, the passenger intensity continually increased till it was around 7 pass/m2 at Kobri Elkobba station to Elmataria station where a little decrease to be 5 pass/m2 at Ezbet Elnakhl, and 3 pass/m2 at Elmarg. On the other side on the down direction, the passenger intensity into cars varied within 6 – 7 pass/m2
- For 2nd line: the passenger intensity into cars was not exceeding 4.7pass/m2 and 2.7pass/m2 for up and down directions respectively.
- For the 3rd line: the passenger intensity was found less than 3pass/m2 for up and down directions.

d) Investigate the socio-economic impact for metro stations.

One can conclude that the decrease rate of metro passengers on 2017 comparing with the corresponding month with 2018 is less than decreasing rate of July 2018. While the ticket increased from 1L.E to be 2 L.E for all travel distances from January 2018 to June 2018. A large increase on July 2018 has happened (3L.E for first 9 stations, 5L.E from 10 to 16 stations and 7 L.E for more than 16 stations). So the passenger decrease was very large at summer vacations to be constant during education semester.

e) Predicting the daily revenue under different scenarios.

Applying different scenarios on the passengers for every zone and the corresponding revenue, one can conclude that the revenue when the 1st zone becomes 10 stations instead of 9 stations will increase by 0.91%, 0.93% for 1st line up and down directions respectively.

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V. RECOMMENDATION

a) Waiting passenger intensity on the platform Zone.

It is recommended to give instructions for metro passengers' users to uniformly distribute along metro length within the waiting platform width.

b) Passengers' Exchange Time

It is preferable to put platform signs indicating the boarding and alighting zones and controlling the passenger behavior by giving immediate penalty.

It is observed that some passengers still let the metro doors opening by force, so an instant violation is required.

c) Intensity into Cars

For 1st line, it was noticed that the trip from Maadi to Helwan (up and down) was smaller than the standard intensity on the off peak hour (3pass/m^2), so it is advised to double the headway for trips between Elmarg to Maadi.

d) Investigate the socio-economic impact for metro stations.

The effect of ticket price increase has a great value from 2L.E to 3 zones ticket. For the same conditions, so it is recommended to study deeply this effect before deciding the increase.

REFERENCES:

1 Hansen 'Review of planning and capacity analysis for stations with multiple platforms e Case Stuttgart 21 Ingo' Journal of Rail Transport Planning & Management 6 (2017) 313-330

2. Katsuyuki NAKAMURA, Huijing ZHAO, Ryosuke SHIBASAKI, Kiyoshi SAKAMOTO 'Visualizing passenger flow in railway station using laser scanners Article' · January 2005

3. E. Prassler1, J. Scholz1, and A. Elfes 'Tracking People in a Railway Station during Rush-Hour 2' ICVS'99, LNCS 1542, pp. 162–179, 1999.

4. E Prassler, J. Scholz, M. Strobel. MAid: Mobility Assistance for Elderly and Disabled People. In Proc. of the 24th Int. Conf. of the IEEE Industrial Electronics Soc. IECON'98(to appear), 1998.

5. Mai M Eldeeb , Akram S Qotb , Hany S Riad , Ayman M Ashour "Optimal operation interaction (passenger/train/platform) for Greater Cairo Underground metro (GCUM) 1st and 2nd line".

الوحدة الإستشارية للنقل والمرور – كلية الهندسة – جامعة عين شمس , مايو 2004 (6)
"دراسة رصد حركة الركاب على محطات السكك الحديدية وتحديد المطلوب لها والمقترحات الخاصة بتطويرها" وزارة النقل – الهيئة العامة لتخطيط مشروعات النقل.
(CUTPTE, 2004)

(7) وحدة الإستشارية للتخطيط المعماري والحضري – كلية الهندسة – جامعة عين شمس, يوليو 2007 "عرض مرحلي لسياسات وإستراتيجيات تطوير محطات القطارات المصرية" وزارة النقل – هيئة سكك حديد مصر
(DRASUS, 2007)

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