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Toward an Optimal Deployment of Ambulance Service Facilities in Riyadh, Saudi Arabia

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Abstract. Efficient provision of emergency services is of vital **importance** to urban governments. Emergency services are commonly known to include ambulance, fire, and police services. These services have geographical distribution characteristics of request of service on one hand and a system of facilities deployed to respond to that request, on the other. Proper allocation and location of emergency service facilities in an urban environment contribute significantly to the efficiency and effectiveness of providing emergency service. Planning, being concerned with spatial distribution of emergency services in the urban environment, can contribute to the efficiency and effectiveness of providing emergency services.

The purpose of this paper is to analyze the existing allocation and location of ambulance service facilities in the city of Riyadh and to recommend an alternative strategy for the deployment of ambulance service stations within the city, comparing also the expected performance of such deployment with those of the present deployment.

For this purpose, the. "**Parametric** Allocation" and "Site Evaluation" models were calibrated to provide the analytical basis for subsequently focusing on the **requirements,** constraints and results of the tests of those models, along with recommendations for their **future applications.**[1]

Keywords: Emergency services, location, allocation, site evaluation, parametric allocation, land use, time-distance relationship.

Introduction

Effective and efficient provision_ of emergency services is a principal function of urban

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1 The parametric allocation and site evaluation models were developed by RAND Corporation, Santa Monica, California and New York. The latest version, so far made available by RAND of PAM and SEM were used as the basis of this research.

governments with implications ranging from rational use of resources for the security and well-being of the urban population to matters of governmental authority. Spatial distribution, i.e. allocation and location of emergency service facilities within urban setting, contributes significantly to the efficiency and effectiveness of providing emergency services. As any spatial urban phenomenon, spatial distribution and location concern planning. However, until recently, planning concern with spatial distribution of emergency services had been limited to application of rudimentary distribution standards and principles; e.g. one service station per given size of population. With the development and use of analytical models, more rational distribution of emergency service facilities have now become possible.

Extensive studies, spanning over some 40 years period, have provided the background and easy use of analytically-based models and related computer programs originating in the western world.[2] Especially noteworthy among these analytically-based models are those developed and used extensively in the U.S., by the Rand Corporation: Parametric Allocation Model (PAM) and the Site Evaluation Model (SEM)[3] [1, 2]. The use of these models for allocating and locating all emergency service facilities i.e. the emergency medical services, fire services, and police services, was suggestive of their potential utility and adaptability for the Saudi Arabian city context.

This paper attempts to formulate a strategy for deployment of ambulance service stations within the city of Riyadh utilizing the Parametric Allocation Model (PAM) and the Site Evaluation Model (SEM)[4]. It seeks also to demonstrate the applicability of these two models in large Saudi Arabian cities, along with conditions and limitations of application. As such, it attempts to draw the attention of planners and city managers of emergency services to emergency service allocation and location matters. It is hoped that knowledge gained on the issues and problems emanating from the applications and adaptation of these models in a non-Western city context would contribute to knowledge and lead to valuable suggestions for applications of similar nature in other spatial and institutional contexts.

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2 For a good survey of extensive works carried out by Rand, PTI, etc., see Carter *et al* [3], Kolesar and Swersey [4], Larson [5], Walker [6], and P.T.I. [7].

3 For discussion of the particulars and use of these models, see Dormont [8,9] and Rider [2].

4 These two models were selected as their formulations and data requirements provide a better fit to the operational environment and data presently available in Riyadh. Recent (1994) communication with the authors of these models confirmed our use of the last updated version of the models. Other class of models, e.g. the Hypercube Model, are applied in selected U.S. cities where emergency systems and their management are relatively mature; see, Bradeau and Larson [10]. These types of models represent a further advancement in management and operations and demand an advanced level of service operations and detailed and extensive data collection which does not exist in the context of emergency services operation in the selected cities.

On the Nature of Ambulance Emergency Services

Ambulance service is a typical emergency service having all of the attributes that characterize and distinguish this service from other services provided by municipal governments [5, 6]. Some of the attributes of emergency services relevant for the purposes of this paper include the following:

- Emergency services involve incidents that occur throughout the city.
- The time and place of occurrence of the incident cannot be reliably predicted on an individual basis.
- In response to each call for service, one or more emergency service vehicles are sent to the scene of the incident.
- The total time taken by the emergency service vehicle in arriving at the scene of the incident from the time of service request has strong influence on the actual, or perceived, quality of the service provided.

Ambulance services provided within the framework of emergency services, encompass the following functions:

1) traveling to places where incidents occur,
2) meeting the need of the victim of the incident at that location,
3) providing basic life support (e.g. applying cardiopulmonary resuscitation care and cardiac monitoring in the case of cardiac arrest), and then
4) proceeding to either health care center or back to base station.

These functions are performed within a spatial setting; i.e. the urban environment. The urban spatial environment, in conjunction with the demographic characteristics of the population (and their spatial distribution) influence the need for and the efficiency of the delivery of urban emergency services. Since both the urban spatial structure and its demographic patterns cannot be modified easily, the location of emergency service stations (or facilities) must be adapted to the form and characteristics of the urban environment.

The planner's and service provider's concern with ambulance services involve the determination of the number of service stations, their allocation, and location in a given city, observing the spatial and non spatial characteristics of this service, including also specification of performance measures that will be used in "optimizing" the deployment of facilities.

Methodology, Model Calibration and Results

The efficient delivery of ambulance services (or, emergency services in general) depends primarily on two variables: first, the geographical distribution and the demand for services and second, the time it takes to deliver the service. The Parametric Allocation

Model (PAM) focuses on the allocation of a given number of units to the pre-designated geographical zones of service. The model operates on the basis of a trade-off parameter which emphasizes selected performance objectives. The two commonly used performance objectives are equalizing of average travel time to incidences in each protection zone and minimizing the average travel time to all incidence throughout the city. The model can be used to evaluate allocation proposals and to predict the values of the performance measures resulting from the proposed pattern of allocation. Given the value of the performance objective, the model can also be used to determine the best allocation of a given number of service units to protection zones. The Site Evaluation Model (SEM) receives the number of units to be allocated from the Parametric Allocation Model (PAM) and proceeds to evaluate the adequacy of the units' location within each protection zone as well as possible consequences of arrangements of units on each other.

The use and calibration of these models, in order to provide alternative strategies for the deployment of emergency service facilities in any city or region, requires the collection of (or have readily available) sufficient data to estimate geographical demand and/or risk profile.[5] In addition, it is necessary to have readily available an estimate as to the length of time required for a vehicle to traverse specified distances while responding to requests for service (i.e., a time versus distance relationship).

First, geographically based demand analysis is essential to the analysis of potential risk. Analysis of risk may not be based upon a known uniform geographically distributed catchment area, but rather, is based upon an assessment of the prospects, or probabilities, of future demand, and the potential hazards in not providing proper ambulance service to a given area. For example, it may be the case that an elementary school historically has had little demand for ambulance services. However, the potential hazards being risked in not providing an adequate service to such a facility are very great, due to the high day time population densities associated with such a facility.

Land use data, here, provides the best data source in order to obtain an estimate of the present risk for ambulance services. For the City of Riyadh, land use data stratified at the sub-municipality and sub-hara levels were made available on the Urban Intelligence System of the Arriyadh Development Authority (ADA). ADA's land use information survey of 1990 was used to derive the index values that were subsequently used in determining "homogeneous, potential demand-hazard" zones. Further information of considerable value for this analysis are also included the overall demand rate of requests

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5 Although data limitations usually exist in performing such an analysis, sufficient data have been made available through Arriyadh Development Authority (ADA) and the efforts of the researchers under the auspices of KACST Project AR-6-111. These primary data collected and secondary data available will be discussed in addition to their appropriate application. Through this analysis, it is hoped that the direction will be pointed in which further development must progress so that improvements in subsequent analysis may be realized.

for service on a city-wide basis.[6] The index values, determined normatively and through consultations with emergency service officials, shown in Table 1; has considered the "incidence" by land use as observed in Riyadh, as well as the "Stand-by" and "critical" importance levels identified by ambulance officials.[7] The weights were used along a scale of 1 to 9 representing least to most important. These indices were multiplied by the area value (sq.m.) of land use present in each sub-hara to obtain weighted "hazard score" values. These "hazard scores" were then normalized and subsequently grouped into six categories of homogeneous areas. Figure 1 provides graphical view of the spatial distribution of the computed relative hazard scores in Riyadh sub-haras. These data are necessary requirements in utilizing ambulance services deployment models.

Time-distance relationships is required in order to provide adequate assessment of the timely delivery of the services. The time versus distance relationship can vary somewhat from one city to another, seemingly based upon the structural arrangement of the city's street patterns and, particularly, upon the nature of the hierarchical street network. This

Table 1. Distribution of assigned hazard score indices by selected land use for ambulance service in Riyadh

Land use code	Land use	Total weighted hazard scores (Incidence/Standby/Critical)
1	Residential	9
123	Dormitories	10
124	Orphanages	10
13	Residential hotels	11
142	Work camps	8
15	Transient lodging	3
2	Manufacturing A	3
3	Manufacturing B	3
4	Communication	6
5	Trade	3
6	Services	7
68	Educational	9
6915	Pilgrim area	18
688	Special ed./Handicapped	18
72	Public assembly	18
73	Fairgrounds	9
74	Recreational activities	9

6 This information was provided by the Saudi Red Crescent Society, in the Statistical Yearbook of the Kingdom of Saudi Arabia [11]. The Saudi Red Crescent Society also provided information on 1100 requests for service in Riyadh during the September to December, 1986-1987 time period [12].

7 In combining observed incidence and given stand-by and critical levels, the index value is assumed to approximate the service demand more realistically. In all cases, earlier model tests have showed less sensibility towards demand distribution than, for example, time distance relationships [13].

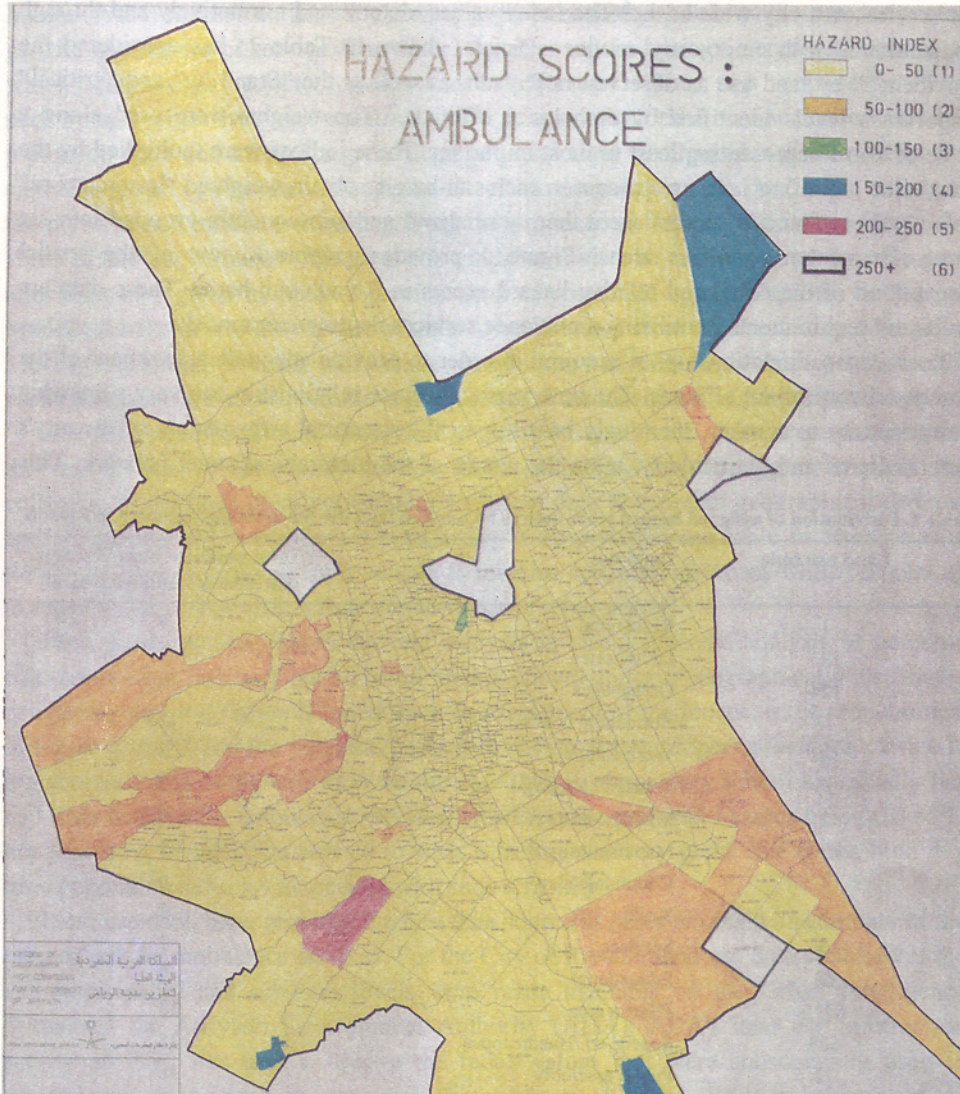

Fig. 1. Computed relative risk of Riyadh sub-haras.

may be particularly true in the case of the city of Riyadh with its varied traditional, grid, and special urban street patterns. Prototype data, representative of the time-distance relationships for the city of Riyadh, was provided[8] [13]. In Riyadh setting, it was necessary to derive several relationships between time and distance. Specific time-distance relationship was derived for areas of the city with similar land-use characteristics and street configurations. Others were derived for distinctively different areas. The classification technique known as "single linking" was employed in order to categorize sub-municipalities within the city. [14, pp. 34-39].

Riyadh may resemble, in some areas[9], other cities for which PAM and SEM were tested in various ways, particularly in the characteristics of land use structure and patterns of the entire metropolitan area, including its suburbs. Hence, immediate consideration of similar time versus distance relationships to those applied in the other cities is plausible. However, due to differences in urban districting in Saudi metropolitan areas, which, in turn, affect the service's time versus distance relationships, it is necessary to take these differences into consideration. A single equation relating time to distance may be a reasonable assumption in the American setting, for example, but may not be reasonable in the Riyadh setting.

As such, the approach to the use of the models has to be modified from single step analysis (which usually produces an optimal solution) to a multi-step analysis, using the same model, in order to accommodate the distinctively different characteristics of separate areas within the city of Riyadh. The solutions expected from this approach are optimal for the respective area and their serving stations.[10] Important also to the use of the models is the functional form of the relationships. The two models used in our analysis, the Parametric Allocation Model (PAM), which considers only a multiplicative relationship between time and distance, and the Site Evaluation Model (SEM), which implements a piece-wise square-root/linear (spline) fit to obtain the time versus distance relationship. A research group at the Rand Corporation has determined that:

> "The functional form that we have found to be most useful provides a square-root relationship between time and distance up to some distance, d, and a linear relationship for distances greater than d" [8, p. 13].

The use of the models is governed also by the specific service delivery criteria defined by the management of the emergency service. In order to determine a proper deployment

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8 The city's haras and subharas were classified in accordance with their street pattern and a sample of these subharas was selected. 267 observations were made in 5 sample haras. The time, distance and street conditions data were collected; See Third Report [13].

9 Specifically, the city of Riyadh includes many urban areas of relatively low density which might very well be part of an adjacent subrub in the other setting.

10 The model requires a single time/distance relationship equation. Alternatively, therefore, an approximation of all separate areas could be used. This provides a city-wide solution that is sub-optimal for each of the respective areas.

of emergency service facilities for the ambulance service in the city of Riyadh, a criteria for evaluation had to be established. The criteria, as utilized for the purposes of analysis, were stated by the Red Crescent Society as follows: "for 90% of all types of calls within cities, an ambulance should arrive at the scene within 6 minutes of the receipt of the request by the dispatcher." Data was collected for the city of Riyadh[11] this information coupled with the data showing that 6% of all calls [12, p. 5] were received during the peak hour (9:00-10:00 p.m.) permits one to compute an average peak hour request rate of approximately 0.60 requests per peak hour.

Since the PAM model operates as an analytical (non-linear programming) model, the model computes an average travel time (and average travel distance) to requests for service.[12] Since the PAM acts as an analytical model, rather than a simulation model, computing the 90th percentile of the distribution of the time required to respond to all requests cannot be accomplished without further information. Specifically, one must determine the average response time that would approximate a normal distribution having the 90th percentile lying at 6.0 minutes (value of the operational criteria). Data collected in the time versus distance experiment showed a coefficient of variation (ratio of sample standard deviation to sample mean) equal to 0.389.

In consideration of the operational criteria of desiring to arrive at the scene of incident within 6 minutes (in 90% of these requests) from the time of receipt of the request by the dispatcher, average travel time results as follows:

AVG. TRAVEL TIME	=	OPERATIONAL CRITERIA (std. dev. *z0.9)
STD. DEV./AVG. TRAVEL TIME	=	0.389
AVG. TRAVEL TIME	=	(6 MIN.) - (0.389*AVG TRAVEL TIME * 1.28)
	=	4.01 MIN.

Thus, an average travel time of 4.01 minutes will result in 90% of the requests for service being met within 6.0 minutes. Given the standard of an average travel time to an incident of 4.01 minutes or less, if possible, the objective of the analysis becomes one of

11 It was documented in a report provided by Red Crescent that requests for ambulance service in Riyadh (similar to Jeddah) were relatively low in number. During a three-month time period in 1986 for which data was collected, [12, p.1] the entire city of Riyadh had 903 records of requests for service. The low number may not indicate the lack of need of the services. It indicates, however, that other means were used to serve and move victims of incidents to health care centers.

12 The computer model to be employed in such an analysis must reflect the data available - -the variables specified and their degree of specificity. The PAM model satisfies this criteria respecting the limitations of the data available [8]. Thus, the PAM was chosen as the model to be employed in attempting to ascertain a "general picture" of the number of facilities and location of facilities to be deployed in the city of Riyadh in order to meet specified criteria.

the Manfouhah sub-municipality, this time standard had to be modified in order to avoid deploying an inordinate number of facilities in that area. A time standard which provided for 50% of the requests for service being responded to within six minutes enabled the Manfouhah sub-municipality to be allocated with 6 facilities in order to provide that level of service. See Table 4 for the resulting average times and distances for each sub-municipality as computed by the PAM.

Table 3. Computed optimal deployment from the parametric allocation model for ambulance facilities in 32 Riyadh locations

Sub municipality	Hara	Sub-Hara
Shumaisi	09	03
Olaya	08	07
Malaz	05	01
Batha	07	04
Ma'ather	06	01
Eraigah	02	05
"	12	01
North	01	01
"	10	02
"	15	04
"	21	02
Al-Roudah	06	01
"	11	01
Al-Naseem	03	01
"	09	02
Sinaieyah	03	11
"	04	01
South	08	01
Manfouhah	02	01
"	04	01
"	04	03
	05	04
"	08	02
"	10	01
Itaigah	05	01
"	09	01
Al-Oraidh	01	04
Ergah	02	01
Far North	01	03
East	04	02
"	06	02
Northeast	01	01

Fig. 2. Geographical distribution of proposed deployment of ambulance stations.

Table 4. An optimal allocation and deployment of ambulance facilities for the city of Riyadh

Sub municipality	Number of facilities	Avg. travel time (Min)	Avg. travel distance (KM)
Olaya	1.00	3.71	3.60
Shumaisi	1.32	2.62	2.35
Malaz	1.08	2.85	2.53
Batha	0.65	3.60	3.10
Maa'ather	1.21	3.14	2.75
Diplomatic Qtr.	0.18	4.04	3.42
Erigah	0.18	5.66	4.59
Al-Naseem	1.98	3.75	3.21
Al-Ha'ir	1.62	5.56	4.53
Ergah	0.40	10.48	7.85
Dariyah	0.28	6.35	5.07
Al-Oraidh	1.19	4.77	4.69
Far North	1.04	4.14	4.04
Northeast	0.07	3.08	2.96
North	3.45	3.57	3.45
Roudah	2.01	3.92	3.81
Sinaieiah	1.82	4.84	4.75
South	1.42	4.72	4.64
East	2.26	3.66	3.54
Itaigah	2.04	3.75	3.64
Manfouhah	6.00	5.97	1.80

Comparison between proposed optimal deployment and present deployment of ambulance service facilities

The Site Evaluation Model (SEM) provides the means for comparing alternate deployments of ambulance service facilities geographically over an urban area. Thus, the SEM was employed in order to compare the proposed 32-facility deployment, as determined using the PAM, with the 7-facility deployment presently in operation.

In order to employ the SEM, the exact locations of all of the proposed and present ambulance facilities must be specified on a coordinate grid. Imposing the assumption, as required by the SEM, that the facilities can be located only at the centroids of the demand areas to be studied forces a slight approximation upon the specification of deployment. However, very precise and accurate data concerning the locations of the 585 sub-haras of Riyadh provide for low error in the specification of the locations of facilities. Using the coordinates of the centroid of the sub-hara at the furthest point to the south and west (of the origin of the coordinate system) of the city enable one to specify the distance (to the nearest meter) of all of the centroids of the 585 sub-haras with respect to the origin, and hence, with respect to each other. See Tables 3 and 5 for a list of locations of the proposed and present facilities.

Table 5. Present deployment of ambulance facilities in 7 Riyadh locations

Sub-municipality	Hara	Sub-hara
Shumaisi	02	06
Shumaisi	10	01
North	09	01
Al-Naseem	10	01
South	04	07
Manfouhah	09	02
East	06	01

Table 6. Site evaluation model results for present and proposed deployment of ambulance facilities in Riyadh

Deployment	Average travel time (mins)	Average travel distance (km)	Maximum travel time (mins)
Present	14.51	5.89	60.73
Proposed	9.68	3.94	36.38

The SEM further requires a time versus distance relationship to be specified and to be applied to the entire urban area. Thus, in order to determine an overall curve fit, characterizing the relationship between time and distance for the entire city, the urban area must be treated homogeneously (i.e., the travel characteristics are assumed to be the same at all points over the city). This is a simplifying assumption which does not appear to hold for the city of Riyadh, as demonstrated by the information provided in Table 1. However, for the purposes of comparing SEM runs, this assumption may be reasonable, though results from the PAM should not be compared to results from the SEM.

The SEM requires a spline (piece-wise square root and linear) curve fit, rather than a multiplicative curve fit. For the city of Riyadh a spline curve fit was computed, with the parameters as follows:

$$T = \frac{2.16 * D0.5 \ , \text{for } D < 2.16}{0.48 + 2.41 * D \ , \text{for } D > 2.16}$$

The resulting average times and distances for the proposed and the present deployments are shown in Table 6.

General Conclusions and Recommendations

The findings of the study indicate that reasonable results can be obtained from employing analytical models to the allocation and deployment of ambulance service facilities in Riyadh; and possibly all other emergency services facilities in major cities of the Kingdom.

The city of Riyadh, as many other cities of the Kingdom, has grown immensely in recent years, rendering the present ambulance service deployment insufficient and a redeployment study critically important. The results of this study demonstrated that an optimal distribution of the proposed facilities could be obtained accommodating the adopted desirable levels of emergency service provision (e.g. total coverage of the city development area within a response time of less than 6 minutes). The findings testify to the improvement in service levels expected from the proposed redeployment of ambulance service facilities in Riyadh.

In fact, several deployment possibilities can be quickly examined testing different assumptions of service levels and spatial-organizational resources in order to select the best alternative for action. However, the availability of reliable and systematic data becomes critically important for such studies to be conclusive for final policy development and action.

In studying the available data related to assessing ambulance service provision within the city of Riyadh, it seems fair to conclude that the data available are inadequate in order to provide a definitive optimal geographic deployment of facilities. The data which have been identified as lacking are the following:

1. A geographical demand profile over the city of Riyadh.
2. Actual data points which could be analyzed to relate time to distance traveled, in responding to requests for ambulance service within the city of Riyadh. Preferably, these data points should be stratified at the sub-hara level of aggregation.

Without these data, it was necessary to collect some primary data in order to compute time versus distance relationships and to employ an analysis of risk in order to arrive at conclusions and make recommendations.

Obviously, such conclusions and recommendations will be somewhat attentative, but can demonstrate that the methodology employed is capable of arriving at definitive conclusions and recommendations when the aforementioned data become available.

While the PAM is adequate in providing a "general picture" of how an optimal deployment of ambulance service facilities in Riyadh might appear, it is inadequate in determining specific optimal sites for facilities. In order to employ computer models which would provide greater specificity in an optimal deployment, more specific data is required.

The employment of the Site Evaluation Model (SEM) requires precise information, including the following:

1. The geographical location of each city block within Riyadh (using a coordinate grid system).
2. The number of requests for service that occurred in each city block over a reasonable length of time.

In order to gain this information concerning the request for service, it is necessary to collect data related to demand for service organized by street name and building number.

At the present time, numbers have not been assigned to buildings within the city of Riyadh. In fact, many residential streets have not yet been assigned names. Thus, before adequate data can be collected to use more powerful computer models, it is necessary to provide basic spatial identification mechanisms (i.e., street names and building numbers).

In addition, with the advent of Geographic Information Systems (GIS) applications to the urban environment, data can be readily available on land uses and on other relevant statistics. GIS as such, can be considered as a repository of information useful for direct incorporation into models like PAM and SEM. PAM and SEM type models could be integrated into the total GIS environment as knowledge-based expert systems components. This approach, however, requires dedicated efforts by planning and emergency services to input and update data continuously. In the absence of relevant GIS-based data in the emergency services in the city of Riyadh, traditional approaches to data collections and calibration were used.

In the case of Saudi cities, the benefit gained from the use of PAM and SEM as expert support systems remain valid even in the absence of GIS. The integration of the GIS-based information into these analytical models constitute a natural progression toward use of emerging systems for graphical analysis as informational base for the operations of these models.

References

[1] Hausner, J. *Determining the Travel Characteristics of Emergency Service Vehicles. R-1687-HUD*, 1975.

[2] Rider, K.L. *A Parametric Model for the Allocation of Fire Companies*. The NYC: New York; Rand Report R-1615-NYC-HUD, 1975.

[3] Carter, G.; Chaiken, J. and Ignall, E. *Response Areas for Two Emergency Units*. New York City: Rand Inst., R-532-NYC/HUD, 1970.

[4] Kolesar, P. and Swersey, A. "The Deployment of Urban Emergency Units: A Survey." In: Swersey, A. and Ignall, E. *Delivery of Urban Services with a View Towards Application in Management Science and Operations Research*. North Holland, 1986.

[5] Larson, R. *Methods of Allocating Urban Emergency Units:* A Survey. New York: Rand Inst., Report P-47, 1971.

[6] Walker, W. *The Deployment of Emergency Services: A Guide to Selected Methods and Models*. New York City: Rand Institute Report R-1867/HUD, 1992.

[7] Public Technology Incorporated (PTI. *Ambulance Service Location Package*. Washington, D.C.: U.S. Department of Housing and Urban Development, 1978.

[8] Dormont, P. *The Parametric Allocation Model: User's Handbook*. N.Y.C.: Rand Institute; WN-9195-NYC, 1975.

[9] Beltrami, E.J. *Models for Public Systems Analysis*. New York: Academic Press, 1977.

[10] Bradeau, M. and Larson, R. "Extending and Applying the Hypercube Queing Model to Deployment Ambulances in Boston." In: *The Institute of Management Sciences TIMS*, 22, 121-153, Elsevier Science Publishers, 1986.

[11] Saudi Red Crescent Society. *Statistical Yearbook(s) (1402H, 1403H)*; Riyadh, Saudi Arabia.

[12] Red Crescent Society. *Trial Run Report Analysis*. June, 1987.

[13] *Third Report, Emergency Services Location in Saudi Cities*. KASCST AR-6-111.

[14] Gordon, A.D. *Classification*. Chapman and Hall, 1980.

نحو تخصيص أمثل لمواقع خدمات الإسعاف في الرياض بالمملكة العربية السعودية [١]

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(قدم للنشر في ٢٥/ ١٢/ ١٤١٣هـ، وقبل للنشر في ١١/ ٦/ ١٤١٥هـ)

ملخص البحث. إن توفير خدمات طوارىء ذات فعالية هو من أهم الأمور الحيوية في إدارة شؤون المدينة. وخدمات الطوارىء تضم الإسعاف والإطفاء والأمن والتي تتميز جميعها بالتوزيع الجغرافي والمكاني لتقديم خدماتها من ناحية وكذلك بأنظمة خدمة يتم تخصيصها للاستجابة لطلب الخدمة من ناحية أخرى.

وعلى هذا فإن التخصيص والتحديد المناسب لمواقع هذه الخدمات ولأنظمتها يسهم في كفائة وفعالية توفير خدمات الطوارىء. وعلى ذلك فإن استخدام الوسائل والطرق التحليلية لدراسة ونشر خدمات طوارىء (بما فيه تلك المبنية على استخدام الحاسب) كأدوات لتخطيط التوزيع المكاني لخدمات الطوارىء في البيئة العمرانية سيعمل على زيادة فعاليتها وكفائتها.

هدف هذه الورقة هو دراسة الوضع الحالي للتوزيع المكاني ونشر خدمات الإسعاف في مدينة الرياض واقتراح استراتيجية بديلة لمواقع خدمات الإسعاف في المدينة مع إجراء مقارنة توضح توقعات فعالية البديل المقترح مقارنة بالوضع الحالي. ولهذا سيتم تحضير ومعايرة واستخدام نماذج «Parametric Allcation» و «Site Evaluation» كقاعدة تحليلية وبالتالي التركيز على متطلبات وقيود ونتائج العمل بهذه النماذج لتحليل الوضع الحالي واقتراح الاستراتيجية البديلة.

(١) هذه الورقة مبنية على نتائج البحث رقم أر - ٦ - ١١١ المدعم من مدينة الملك عبدالعزيز للعلوم والتقنية.