Simulation of Airport Terminal Facilities in the Greek Airports of Kavala and Alexandroupolis

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Abstract

The airports of Kavala and Alexandroupolis serve a wide catchment area in Northern Greek periphery, offering air transport services to almost half a million habitants as well as to international tourists. The international passengers of Kavala airport are travelling mainly during the summer period with charter flights that impose high peaks in various subsystems of the airport terminal. The airport of Alexandroupolis mainly serves passengers of domestic flights that are usually accompanied by friends or relatives, leading to overcrowding of the corresponding waiting areas. The existence of the above passenger flows peculiarities, indicates the need for an appropriate design technique of the related airport terminal facilities. The scope of this paper is to describe such an approach, based on a simulation model that was used during the master plans of the above airports. The model simulates the flows of both departing and arriving passengers, distinguishing the intra and extra-Schengen flows so as to charge the various subsystems of the airport terminal accordingly, while emphasis was given in the investigation of the level of service offered in the departure lounges.

Keywords: Simulation, airport design, level of service

1. *Introduction*

The development of air transport infrastructure in Greece is of vital importance, as it strongly affects a main link between Greece and the rest European countries and favours the increase of tourist product in Greece, which is considered one of the main sources of income for the country. It should be noted that almost 80% of tourists visiting Greece are coming by air, as passengers of non-scheduled (charter) international flights.

The airports of Kavala and Alexandroupolis (international airport codes KVA and AXD respectively) serve a wide catchment area in Northern Greek periphery, offering air transport services to almost half a million habitants as well as to international tourists. Both airports are characterized as "small" airports as they serve relatively small passengers flows.

The airport of Alexandroupolis, served more than 300,000 passenger movements during 2000 [CAA (2001)]. The majority of passengers travelling through the airport of Alexandroupolis are passengers of domestic flights, who are travelling frequently through the year. These passengers are usually accompanied by friends or relatives while departing or arriving at the airport and as a result the corresponding waiting areas are overcrowded. The international traffic is negligible, primarily composed by Greek immigrants who visited their native land during national and religious holidays. This state is expected to be overturned in the future due to positive perspectives for the economic growth of this region.

The passengers' movements served by the airport of Kavala exceeded 400,000 in 2000. About 200,000 of these movements were domestic, while more than 200,000 consisted of international passenger movements, (originating primarily from Germany, England, Netherlands and Austria) mainly during the summer period [CAA (2001)]. These flows of international passengers are travelling with non-scheduled (charter) flights. The characteristics of these passenger flows are quite different from those of domestic flights and as a result high peaks are generated in various subsystems of the airport terminal, especially in the check-in areas and in the departure lounges.

The continuous increase of tourists visiting Greece with non-scheduled (charter) flights significantly affects the operating conditions of the existing airports while additional difficulties are imposed due to the application of the Schengen Agreement, which imposes the distinction of passengers flows according to intra-Schengen and extra-Schengen countries' destinations. Since, neither the airport of Kavala nor the airport of Alexandroupolis can easily cope with the new operating conditions, the Civil Aviation Authority launched master plan studies for both airports in order to confront these problems but also to investigate solutions that would relieve both airports in the long run [OBK (2002)]. Due to the existence of the above-mentioned passenger flows peculiarities, the design of the related facilities was supported by a simulation model. The scope of this paper is to present this model, the core of its mathematical formulae (Section 3) and an application performed within the master plan studies of the Greek airports of Kavala and Alexandroupolis (Section 4).

2. *Airport Terminal Design*

The sizing of the airport terminal buildings of Greek airports complies -in general- with the existing international regulations and calculation methods of ICAO (International Civil Aviation Organization), IATA (International Air Transport Association) and FAA (Federal Aviation Authority). Nevertheless, this approach is not always adequate as it is strongly oriented to the sizing of "big" airports serving a significant number of scheduled flights and assumes relatively smooth passenger flows. On the contrary, the majority of Greek airports are classified as "small" airports (due to the limited number of annual enplanements) that during the summer period are serving a significant number of charter flights. Due to the peculiarities of the associated passenger flows, high peaks are generated in several subsystems of the airport terminal building.

This fact imposes specific requirements for the sizing of the related facilities and installations [Ballis (2001)]. In such cases, the implementation of a «most commonly used» technique for the design of the airport terminal facilities can lead to undesired results. The application, for example, of the 30th busiest hour design methodology, for the design of a medium/big airport, usually leads to airport terminal facilities offering a good level of service (with the exception of 29 hours per year). However, in the airport of Kavala this consideration is not valid. The passenger volumes are concentrated during the summer holidays, in a short period of four-months, in one day during the week (4 flights within the peak hour). Therefore, applying the 30th busiest hour design methodology, would lead to the design of an airport terminal building that would offer a low level of service to the travellers during almost the entire touristy period. The need for a flexible design tool/method that would be able to adopt the actual operation conditions that an airport terminal confronts, arises after considering the above, especially when it comes to "small" airports.

3. *Airport Terminal Simulation Model*

A flexible -simulation based- design tool/method had been initially developed within a research, performed during the master plan study of the airport of Heraklion in Crete where extensive field surveys had been performed and various modelling tools had been developed [NTUA (2001)]. This simulation model was later on modified to incorporate the special characteristics of the airports of Kavala and Alexandroupolis.

The model simulates both the arriving and departing flows in order to size the corresponding facilities of the airport terminal building. In this paper, only the simulation of the departing passengers in the airport of Kavala is analytically presented, although the simulation of the arriving passenger flows follows a similar procedure. The above departing passenger flows are simulated taking into account the characteristics of the associated arrival patterns as well as the operating conditions of the check-in counters, security and passport control points and the departure lounges. All the above-mentioned elements are analytically presented hereinafter.

3.1 *Passengers arrival patterns*

The need to define arrival patterns according to specific passengers characteristics is considered critical for the accurate sizing of the airport terminal building, as they affect the way that passengers charge the various subsystems of the airport terminal [Ashford (1992)]. It is observed that passengers travelling for leisure usually come in groups, arriving at the terminal together by chartered busses much earlier in relation to their flight departure [Wong (1998)]. This is also true for most Greek airports, where grouped passengers are arriving at the airport terminal about two hours earlier to their flight departure [Ballis et al. (2002)]. For that reason, the airport terminal model developed enables the user to define the arrival patterns of the departing passengers. The modelling approach (and the associated notation) is presented in Figure 1.

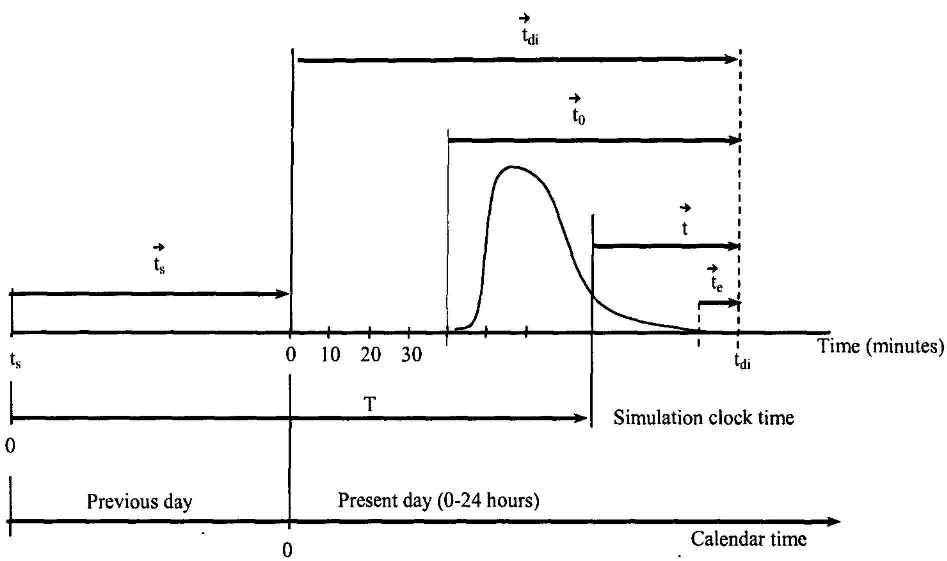


Figure 1. Passengers Arrival Pattern in Relation to Simulation and Calendar Clocks

T stands for the simulation clock time and ranges from 0 to T_{max}. It is a discrete variable increasing in 10 minutes intervals. The start ($T = 0$) of the simulation clock time is aligned to time t_s of the calendar time (previous day). In this way, simulation can accommodate the arriving passengers of a flight departing at time 0 of the calendar clock. T_{max} is defined as the end of the time period with duration $\{\vec{t}_s + 24$ hours $+ \vec{t}_L\}$ where $\vec{t}_L$ is set to accommodate possible delays that may shift departure to the next day (if any) and is determined on a case-by-case basis. Notation $\vec{t}_{di}$ represents the duration between the beginning (time 0) of the calendar time and the departure of flight i. The notation $\vec{t}_0$ stands for the duration between the arrival of the first passenger and the time of the flight departure t_{di}. The time duration $\vec{t}_s$ is defined from the moment t_s (time 0 of the simulation time) to time 0 of the calendar time. The duration $\vec{t}_s$ is set equal to $\vec{t}_0$ to simplify the calculations. The time duration $\vec{t}_e$ is defined between the gate closing time and the time of flight departure. Finally, $\vec{t}$ stands for the duration between passenger arrivals and the associated flight departure time.

If d_{it} is the number of departing passengers of flight i, having arrived at the airport at time t prior to flight departure time t_{di}, then:

$$d_{it} = \begin{cases} [P_{kt} * a_i], & \vec{t}_s + \vec{t}_{di} - \vec{t}_0 \le T < \vec{t}_s + \vec{t}_{di} - \vec{t}_e \textit{ thus } \vec{t}_{di} \le T < \vec{t}_0 + \vec{t}_{di} - \vec{t}_e \\ a_i - \sum_{j=0}^{T-1} d_{ij}, & T = \vec{t}_s + \vec{t}_{di} - \vec{t}_e = \vec{t}_0 + \vec{t}_{di} - \vec{t}_e \\ 0, & \textit{otherwise} \end{cases} \tag{1}$$

where P_{kt} represents the percentage of departing passengers arriving at the airport, at time t prior to flight departure, and a_i is the total number of departing passengers of flight i. The P_{kt} percentages can be defined thought measurements or according to IATA (where applicable) [IATA (1995)]. The total passenger flow at the terminal F_{aT} is given by the following formula:

$$F_{aT} = \sum_{i=1}^{i_{\max}} d_{iT}, \qquad T = 0,\ldots,T_{\max} \tag{2}$$

The associated passenger flows are then processed to the check-in counters. The simulation of this processing stage is presented in the following paragraph.

3.2 *Passengers process in the check in counters*

The check-in service rate affects the passenger queuing time and the queue length for the charter passenger service. IATA suggests a check-in service rate of 2 minutes per passenger. Nevertheless, the measurements in the Heraklion airport had indicated that a rate of 0,5 minutes per passenger can be achieved (although this high service rate can not be recommended as a design standard) [Ballis (2002)]. The relevant measurements in the airports of Kavala and Alexandroupolis indicated an average of 1 minute per passenger for the passenger service.

By default the program assigns two check-in counters for aircrafts having up to 250 seats while an additional counter is assigned for larger aircrafts (other rules can also be applied). In a second step, the passenger process in the check-in counters is performed individually for each d_{iT} pattern. If n_i is the number of check-in counters allocated to flight i, and c is the check-in service rate (passengers per 10 minutes per service point), then the number (s_{iT}) of passengers of flight i having been served at time interval t and the number (w_{iT}) of passengers of flight i, queuing at the same time interval are given by the formula:

$$s_{iT} = \begin{cases} w_{i(T-1)} + d_{iT} & q \le 0 \\ n_i * c & q > 0 \end{cases}$$
$$w_{iT} = \begin{cases} 0 & q \le 0 \\ q & q > 0 \end{cases} \tag{3}$$

where, $q = w_{i(T-1)} + d_{iT} - n_i * c$
$w_{i(T-1)}$ stands for the passengers of flight i queuing one step (of the simulation clock) behind the current system status.

Figure 2 presents the global layout of the passenger terminal in the airport of Kavala indicating the associated facilities and areas. The allocation of the check-in counters vertical to the entrance of the airport terminal building, results in undesirable crossings among the queues of passengers waiting to check-in, (especially those of charter flights that due to their grouped arrival, form long queues in front of the check-in counters), the passengers entering the airport terminal building and the passengers queuing in front of the passport/security control. To solve this problem it was proposed that the departure concourse should be expanded (within the limits imposed by the concrete skeleton of the building) to allow the shifting of check-in counters and therefore to increase the available space for the passenger queues.

3.3 *Passport and security checks according to Schengen rules*

The Convention Implementing the Schengen Agreement took practical effect in March 1995 for the original Parties to the Schengen Agreement (Germany, France, Belgium, Luxembourg and the Netherlands) as well as for Spain and Portugal. Later on, other countries (Italy, Greece, Austria, Denmark, Finland, Sweden Norway and Iceland) also fully implemented the Schengen regime. Citizens of countries implementing the Schengen Agreement can cross the internal borders of these countries without passport checks. The implementation of the Schengen Agreement imposes operational inconveniences and design uncertainties due to:

1. Increased complexity of the passenger processing. The passengers of international fights originating from European countries that visit Greece -for example- can be classified in 3 different groups. The first group accommodates passengers originating from countries belonging both to European Union (EU) and to Schengen Agreement. The second group contains passengers originating from countries that belong to EU but are extra-Schengen (United Kingdom and Ireland). The third group, consists of passengers originating from countries not belonging to EC, but are intra-Schengen (Norway, Iceland). Therefore, depending on the circumstances the airport terminal must provide passport control facilities for passengers originating from extra-Schengen countries (2^{nd} group) and Customs

check facilities for passengers originating from countries not belonging to EU (3rd group).

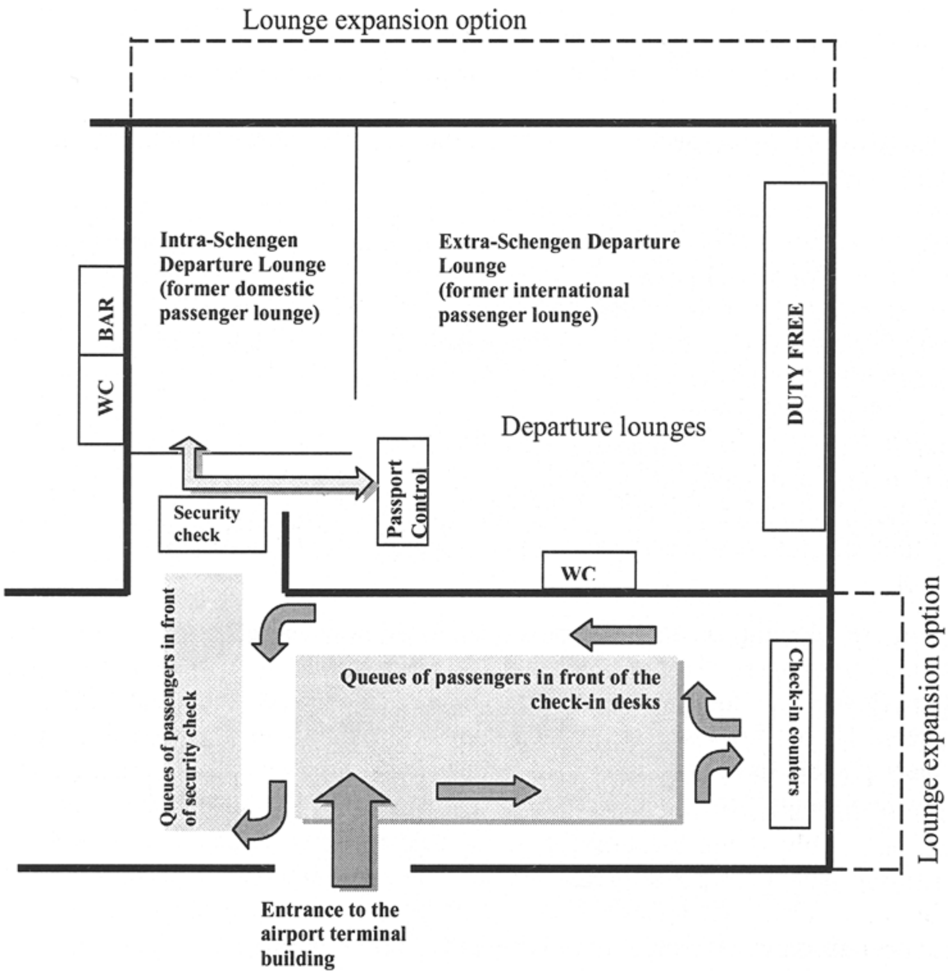


Figure 2. Facilities and Passenger Flows in the Passenger Terminal of Kavala Airport

2. Evolution (in long term) of the percentages of intra-Schengen and extra-Schengen passengers, which are evolved through the years as the participation of countries in the Schengen Agreement is realized gradually. The associated forecast contains a lot of fuzziness. When U.K. (which is now an extra-Schengen country) will join the Schengen Agreement, the extra-Schengen percentages will be significantly

reduced. On the other hand, the number of tourists originating from Eastern Europe (extra-Schengen passengers flows) is expected to increase.

3. Unequal distribution of the intra and extra-Schengen flows in the Greek regions/airports. The today's percentages of intra and extra-Schengen passenger flows in Greek airports vary from {60% intra, 40% extra} to {90% intra - 10% extra}. These percentages are affected by the tourist preferences, which can easily change.
4. Seasonality mainly caused by the concentration of international flights during the summer period.
5. Fluctuation (in short term) of the intra-Schengen and extra-Schengen passenger flows. The above-mentioned intra/extra-Schengen percentages are referring to the total number of annual passenger movements. In short term, these percentages can vary significantly. This is especially true in the case of "small" airports. For example, in an airport that serves simultaneously 2 extra-Schengen and 1 intra-Schengen flights (of the same volume), the corresponding percentages of intra and extra-Schengen passengers are {33 % intra, 67% extra}. These percentages contradict the expected annual average ratio of intra and extra passenger flows.
6. Peak hour conditions. As in almost every transportation system, there is a concentration of high passenger volumes in certain hours during the day. A mid day and an afternoon peaks are common operating conditions for many Greek airport.

In order to take into account the above mentioned intra/extra-Schengen flows, the "simulated" passengers that are processed out of the check-in counters are merged into two flows, one for the intra-Schengen and another for the extra-Schengen passengers. These flows are created by the total number of the intra-Schengen passengers F_{sT} that have been processed by the check-in counters in time T, and are given by the formula:

$$F_{sT} = \sum_{i=1}^{i_{max}} s_{iT}, \qquad T = 0,\dots.T_{\max} \tag{4}$$

where s_{iT} counts only when the flight i is departing for an intra-Schengen country and i_{max} stands for the maximum number of flights in the simulated period.
Similarly an F_{nT} flow pattern is formulated for the extra-Schengen passengers. Moreover the transit passengers flows R_{sT}, and R_{nT} are formulated for the intra-Schengen and extra- Schengen passengers respectively.

These flows then proceed to the security check, the passport control subsystem (only the extra-Schengen flow) and finally to the departure lounges (individual lounges exist for intra-Schengen and extra-Schengen passengers).

In the modelling procedure the user defines the service rate of security checks. These values must be defined for the intra-Schengen as well as for the extra-Schengen passengers flows (where an additional passport control sub-system is also defined). IATA uses the value of 3 passengers per minute for each passport control point and 5 passengers per minute for each security check point [IATA (1995)]. In the airport of Kavala the service rate for the security checks was found to be around 10 passengers per minute per security check point while similar values were observed for the passport control service rates. These rates may change in future, as security checks would become more stringent.

The passenger flow exiting the security and passport controls are calculated in a similar way. Next, the pattern of intra-Schengen passengers (E_{sT}) that are leaving the airport terminal building is formulated as:

$$E_{sT} = \sum_{i=1}^{i_{max}} d_{iz} , \qquad T = 0,....T_{max} \tag{5}$$

where, z is the time of flight departure according to the simulation clock time.

The need for a simultaneous service of intra-Schengen and extra-Schengen passenger flows imposes specific requirements, especially on the operation of small airports that should be able to provide distinct control areas and procedures for distinct passenger flows. This is not easily achieved in the vast majority of Greek airports.

3.4 *Passengers dwelling in departure lounge*

Departure lounges, are considered an important element in the airport terminal building complex, especially when it comes to airports serving significant volumes of charter passengers. The departure and gate lounge facilities are differently served depending on the size and complexity of the airports. For that reason, in some airports these facilities are served in separate areas, while in many cases it is considered more cost-effective to provide common departure lounges that also include gate lounges.

The departure lounge defines the physical end of the departing passengers exploration of the airport. Especially when charter passengers are concerned, they are usually dwelling in this lounge for a significant period of time and therefore they have all the time needed to establish a certain impression of the sense of comfort and relaxation that this facility may or may not offer.

In European airports, after the implementation of the aforementioned Schengen Agreement, two common departure lounges are provided to serve intra-Schengen and extra-Schengen passenger flows. Similarly the simulation distinguishes two different passengers flows.

Assuming that F''_{sT} is the flow of intra-Schengen passengers exiting the security check and entering the departure lounge, the number of intra-Schengen passengers (Q_{sT}) dwelling in the lounge at time T is given by the formula:

$$Q_{sT} = \sum_{j=0}^{T} F''_{sj} + \sum_{j=0}^{T} R_{sj} - \sum_{j=0}^{T} E_{ij}, \qquad T = 0,\dots.T_{max} \tag{6}$$

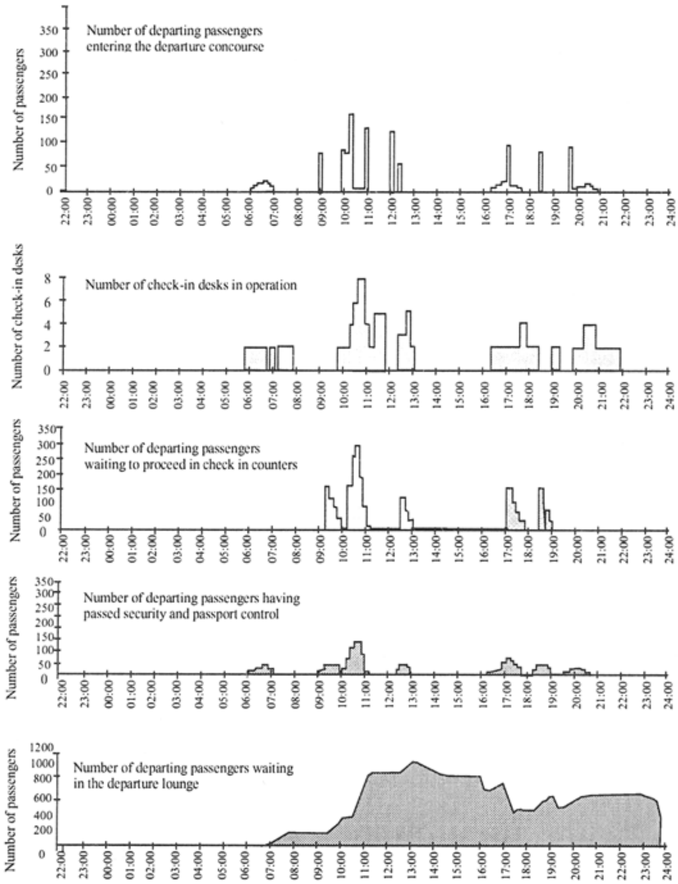
The extra-Schengen passengers flows are formulated in a similar way, but in this case two stages of checking are required: the passport control and the security check. Therefore the corresponding flows are the F'_{nT} for the passport control and the F''_{nT} for the security checks. Q_{nT} stands for the number of extra-Schengen passengers dwelling in the associated lounge. Both Q_{sT} and Q_{nT} are calculated for flight departures occurred within the simulated (t_s to T_{max}) period.

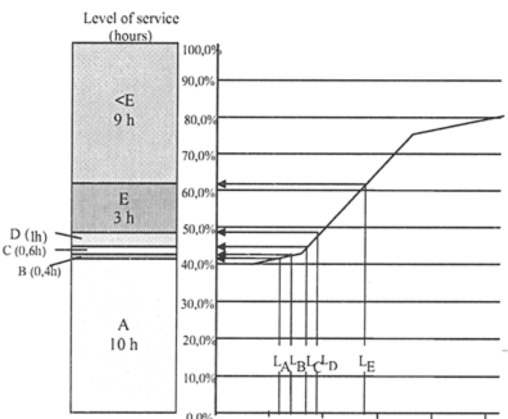
3.5 *Simulation output and data elaboration*

Figure 3 (upper part) presents some of the various plots of the simulation model output for the departure procedures for one simulated day in the airport of Kavala. Similar plots were developed for the Alexandroupolis airport. These plots include the number of passengers entering the departure concourse (according to the associated patterns for the domestic and international/charter arrivals), the number of check-in counters in operation during the day, the number of passengers queuing in front of the check-in counters, the passenger flow being processed from the security and passport control and finally the occupancy (number of dwelling passengers) of a departure lounge. During the elaboration phase of these data these plots were modified to give the daily pattern (00:00 to 24:00).

In this "conversion", it should be taken into account that the operations of the first hours of the day are mixed with operations of the last hours of the previous day. Moreover, the incomplete operations and delays of the last hours of the day are shifted to the next day (when for example, a large number of departures are coincided with the "turn" of the day). This issue (a typical problem of determination of the warm-up and ending conditions of a simulation run) has been analysed in detail elsewhere [Ballis et al. (2002)].

Furthermore, the statistical processing of the departure lounge occupancy data can provide information on the level of service offered over the day. This can be achieved by use of the cumulative distribution, which is an effective way to analyse the departure passenger flows [Barros (1998)]. The lower part of Figure 3 indicates the way that the cumulative distribution, in conjunction with the m^2 per passenger standards of IATA (see the inherent Table in Figure 3) lead to the A,B,C,D and E level of service offered during the 24 hours day period. Although there are not straight rules, a small airport can offer a C level of service, while a lower level (D) can be acceptable only for a limited time within a day. The E level is undesirable/ unacceptable.





Level of service	m² per passenger	Max number of passengers in a departure lounge of 141 m²
A	2,7	L_A = 141 / 2,7 = 52
B	2,3	L_B = 141 / 2,3 = 61
C	1,9	L_C = 141 / 1,9 = 74
D	1,5	L_D = 141 / 1,5 = 94
E	1,0	L_E = 141 / 1,0 = 94

Figure 3. Output Results of the Simulation (upper part) and Data Elaboration for the Determination of the Level of Service Offered in the Departure Lounge (Lower Part)

4. *Airport terminal design for the Kavala and Alexandroupolis airports*

The "production" of quantitative information describing the operating conditions of an airport terminal is only the first part of the design effort. Especially for the expansions/modifications of the existing installations, the "conversion" of this information into technical drawings should take into account the limitations imposed by the existing infrastructure.

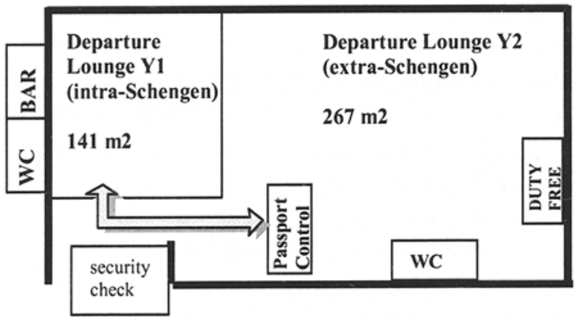
An additional problem arises by the fact that the terminal layouts (and the associated area dimensioning) prior to the implementation of the Schengen Agreement were based on the separation between national and international passenger flows. For example, there were two departure lounges, one for the domestic and another for the international passengers, with passport control booths in the entrance (see Figure 2). After the implementation of the Schengen Agreement the intra-Schengen passenger flows (domestic plus international intra-Schengen countries) are assigned to the former domestic departure lounge while the extra-Schengen passenger flows (international extra-Schengen counties) are assigned to the former international departure lounge due to the existence of passport control facilities. That way, the former domestic departure lounge is usually overcrowded leading –in some cases- in undesirable/unacceptable levels of service.

Figure 4 presents the existing formation (upper part) and the proposed modifications (lower part) for the departure lounges of the Kavala airport as well as the associated levels of service offered. As it can be seen, the extra-Schengen passengers are accommodated in the larger departure lounge, which was initially designed to serve passengers of international flights (and therefore the passport control installations were allocated at its entrance). On the other hand the intra-Schengen passengers are accommodated in a relatively small lounge that is usually congested. Due to this formation, intra-Schengen passengers have no access to the commercial shops. This fact poses a significant restriction to the revenues of the shops, and as a consequence, to the revenues of the airport (due to lower rental of the shops).

The Table attached to Figure 4, indicates the level of service offered in the departure lounge for intra-Schengen passengers, depending on the imposed operating conditions. As it can be seen, when no extra-Schengen flights exist, the two departure lounges are merged in one, by letting open temporarily the intermediate separating door (see case #A1 in Figure 4). Nevertheless, there are less favourable cases (see cases #A2, #A3 and #A4), which at the worst result in a level of service that is under the minimum accepted international standards.

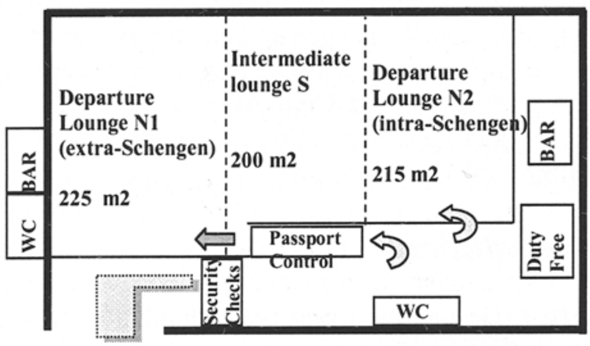
The lower part of Figure 4 presents the suggested design of the departure lounges for a mid-term solution of the above problem.

(a) Existing departure lounges



		Available lounges	Total area (m^2)	Level of Service offered	
				m^2 / pass.	LOS Category
#A1	500 intra Schengen	Y1+Y2	408	0,8	E
#A2	150 intra Schengen	Y1	141	0,9	between D and E
	350 extra Schengen	Y2	267	0,7	between E and F
#A3	350 intra Schengen	Y1	141	0,4	<F (system breakdown)
	150 extra Schengen	Y2	267	1,8	Between C and D
#A4	500 extra Schengen	Y1+Y2	408	0,8	E

(b) Suggested design of departure lounges (utilising the available building expansion)



		Available lounges	Total area (m^2)	Level of Service offered	
				m^2 / pass.	LOS Category
#B1	500 intra Schengen	N2+S+N1	640	1,3	between A and B
#B2	150 intra Schengen	N2	215	1,4	A
	350 extra Schengen	N1+S	425	1,2	B
#B3	350 intra Schengen	N2+S	415	1,1	between B and C
	150 extra Schengen	N1	225	1,5	>A
#B4	500 extra Schengen	N1+S+N2	640	1,3	between A and B

Figure 4. Level of Service Offered in the Departure Lounges in the Airport Terminal of Kavala

The departure lounges are slightly expanded (subject to limitations imposed by the structure of the existing building) and a hall is provided so as to enable access to the commercial shops for all passengers. There is a dedicated WC and a bar allocated to each lounge (this detail was a crucial restriction for the formation of the proposed design). In addition, an intermediate lounge is proposed, which will operate jointly with either the intra-Schengen or extra-Schengen departure lounges. The attached Table depicts the level of service offered with the combined operation of departure lounges (cases #B1 to #B4). It is obvious that the overall performance of the departure lounges is quite improved, as the level of service offered, even under the most unfavourable conditions, is between B and C.

In the airport of Alexandroupolis, a similar approach was followed. One of the main problems faced in the airport terminal, is the limited number of check-in counters (adequate to serve only two airlines). Also there is only one conveyor for the baggage handling of arriving passengers, and in the case that two flights arrive at the same time, congestion and delays are caused. In addition, the handling system of departing baggage is performed with several difficulties. Three alternative solutions were developed for the airport terminal of Alexandroupolis. The first and second solutions were based on the significant rearrangement of the existing terminal areas plus limited building expansions. The main objective was to keep the cost low and to avoid extensive structural interventions. The third alternative was based on the concept that intra-Schengen and extra-Schengen passenger flows should be served at high convenience and therefore a significant extension of the airport terminal building was implemented. The Civil Aviation Authority selected the third alternative as it provides additional motivation for the attraction of international passenger traffic, in the airport of Alexandroupolis.

5. *Conclusions*

Airports serving significant volumes of passengers of charter flights have specific characteristics (arrival patterns, service rates, dwell times) that do not comply with those of airports serving "scheduled flights", especially when it comes to the departing passenger flows. The core of this differentiation is the profile of charter passengers who arrive at the airport in groups, much earlier prior to the scheduled departure of their flights, charging the various subsystems of the airport terminal in such way that leads to high peaks. Therefore the design method and parameters to be taken into consideration are quite different from those established internationally.

The use of simulation in the case studies of the airports of Kavala and Alexandroupolis has proved to be a very useful tool as it permits user-defined input (e.g. passenger arrival patterns, service rates and service point allocation rules) and provides quantitative information about critical design components (check-in area, passport control, departure lounges, etc).

However, no matter the tool used, the "engineering judgment" cannot be substituted. This means, that each case has its unique characteristics, which in combination with the physical restrictions that the structure of the examined airport terminal building imposes, prompt engineers to design with minor or major deviations from the established methods, tools and suggested results. The case studies of the airports of Kavala and Alexandroupolis are justifying this argument, as the suggested solutions were to a considerable extent determined by the existing design concept of the terminal building.

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