CRITICAL ANALYSIS OF EXISTING AIRPORTS' DESIGNS

Abstract: this Article analyses existing designs of the airport terminals, points out major design flaws and undertakes to explain the reasons and origins of such.

The airport buildings, generally referred to as "terminals", belong to the two realms: this of architecture and that of engineering, both in equal grade. On one hand, they fulfil strictly engineering functions, serving as the aircraft docking place. On the other, they serve as intensively used public buildings.

Such combination is not rare, as for example by construction of bridges, train stations, seaports, etc, although professional differences in the approach are often remarkable. For example, the architects are taught to abide by certain "iron" rules of building designs, e.g. level floors, whereas a bridge-design engineer considers with interest driveway/walkway inclination by arc-bridges.

However, certain particularities of aviation as a special mean of transportation cause noticeable competence gap by the designers. Architects, although many of them are also pleasure pilots, act within space defined by building codes and standards, which, although comprehensive, consist of several hundred pages to be fluent with. After a few years of work, an architect is thoroughly familiar with them.

Aviation laws and regulations count several thousand pages, densely cross-referenced, to the extent that people who professionally work in this business are specialists only for narrow sections of it, and often not capable of reaching out to the neighbouring section.

As a result, by the design of the airport terminal, a building wall becomes an interface where the architect ends his function, relaying – with relief - the function to the aerodrome designer, who - in turn – is less familiar with intricacies of floors, beams, stairs, slabs, etc.

This way we obtain some features of the modern terminal, which can be hardly interpreted other than design flaws:

1.The Aerobridges.

The aerobridges, or jetways, became so popular picture in the airports, that almost nobody from general public either general architects can not imagine air travel without them. However, from aesthetical and structural point of view (taking sufficient distance), they bear all traits of palliative, temporary, makeshift solution – more or less comparable to a board thrown across the stream. They serve only one of a few aircraft doors; they are costly and ugly; unfitting to any architectural style; of industrial aesthetic; requiring aviation certification and aviation-grade frequent maintenance; slope often exceeds norms for wheelchair users, unassisted; air conditioning is usually impossible.

2.Floor height.

Ambitious architects nowadays try to shape public space as high as possible and as open as possible (referred to columns span).However, almost none of them is capable of solving relatively simple problem of delivering passengers from/to two various floors – departure floor and arrival floor to a single level of aircraft doors threshold, remaining under 10% limit of aerobridge slope. As a result, we have terminals with exceedingly high, cathedral-range ceilings in departure halls, e.g. 60 m in one newly built airport. This is contrasted with claustrophobically low arrival halls which sometimes do not meet even 2.5m and cause taller passengers to seriously worry about personal safety.

3.Constant floors level.

The aircrafts differ substantially in size; door threshold by most typical passenger jet models vary between 2-5m above ground. Keeping the slope and length of aerobridges in reasonable range and trying to serve all aircrafts and all gates from the same floor levels becomes almost impossible, and leads to the mentioned, cramped lower floor and excessive upper. A simple solution to this is a slightly inclined floor, serving gates from high (big aircrafts) to low (small aircrafts), and keeping healthy proportions between (changing) ceiling height on both floors.

4.Technical services to the aircraft.

From the other side, that of the aerodrome or apron designer are technical functions which have to be delivered to the aircraft as boarding, baggage loading/unloading, refuelling, catering, sanitation.

Although certain sources [1] point out to cabin service or refuelling as being critical path for gate time occupation, but closer look at the detailed timings shows that actually baggage loading and unloading is a major limiter in both: gate time, and interconnectivity for transit passengers. Not surprisingly: although baggage conveyors in modern mega-airports reach speeds of 100 km/h, but the final section, that from the aircraft to the building, requires two times manual handling, each piece.

The functions of catering and sanitation are as a rule delivered from wheeled ground vehicles, although ICAO regulations [4] clearly recommend substituting ground movements as far as possible with stationary solutions.

Almost all these and other technical services problems are possible to be solved via architectural means, but as mentioned, the function of building architect was ended at the building walls.

5.The Tower.

The towers for air and ground traffic control are historical objects. They serve for directing aircrafts on the approach, on the runway, taxiways and on the apron. As a last line of defence, they would ensure optical contact with the aircrafts if all other means fail.

ICAO rules recommend placing aerodrome traffic control in towers providing constant line-of-sight view of all aircrafts. It is becoming increasingly difficult by mega-airports, so is customarily supported with ground radars and – increasingly – with ground cameras. However, ICAO certainly did not mean the race for “skyscraper in the airport”.

Building high towers became kind of a sport and pretence by new airports. But, the idea itself of the tower as an aerodrome-vicinity object remains in a logic discrepancy with other aeronautical rules, as obstacle clearance or frangibility. By new, high terminal buildings quite natural would be locating the tower functions on top of the building, with visibility supported by cameras/radars.

Here ICAO rules [3] suggest anyhow the security reasons as contrary to such solution. True, as even short possible interruption of service might have tragic consequences with several aircrafts on the approach path.

A solution to such security concerns may be one or two reserve small stations in form of manned observation points located by runway ends, with full redundancy of communication/navigation services.

6.Centralised check-in and baggage pick-up.

Again, the present solutions are almost identical everywhere on the globe, what sets limit to the creativity and imagination of the designers. Here, too, the security concerns are taking the lead.

However, with the advent of electronic passport, bio-sensors, facial recognition, body-scanners etc, it has to be assumed that people traffic control will substantially change in the coming years. As the aerodromes are built for hundred years, it is recommendable for the architects to give a thorough consideration to the alternatives for centralised check-in/baggage pick-up, being actually more the bottlenecks than facilitations.

Designing today a mega-airport around the idea of centralised check-in and baggage pick-up is like planning a multi-storey garage with respect to number of horse hitching posts.

7.Conclusion.

Solutions to signalised issues are certainly possible by architectural or engineering means. They require an out-of-the-box, cross-field approach. Some were addressed by the Author in his other publications [6].

The Author is a design engineer with 25 years of experience and commercial pilot.

[1].Planning and Design of the Airports; 2010; Horonjeff et al.

[2].Annex 14 to the Convention on International Civil Aviation ,,Aerodromes” VIIth Edt.; 2016.
[3].Airport Planning Manual. ICAO, Doc.9184,Part1. 2nd Edt.1987
[4]Aerodrome Design Manual. ICAOoc.9157,Part1. 3rd Edt.2006
[5] Aerodrome Design Manual. ICAO Doc.9157,Part 2. 4thrd Edt.2005
[6] Academia.edu ;2019
https://www.academia.edu/39839618/NEW_CONCEPT_OF_AIRCRAFTS_DOCKING_SYSTEM

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