Study & Analysis of The Most Influential Event and Risk in The Workplace Environment at King Abdul-Aziz International Airport

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Abstract: The Safe operation of an airport is an important part of aviation safety. During this study for quality services provided purpose, we will Review types of ground accidents and events that happen at the land side of King Abdul-Aziz Airport (KAIA) during work in the site. The focus of this study will be on KAIA as this airport is an integral part of the world's international airports. We will study the root cause of the ground accidents in the field which is affected by many factors such environment, human, constructions and aircraft features etc.., we will use the (Fishbone) analysis to determine the root cause effects of that incidents and the suggested safety solutions to eliminate the risks in the workplace and reducing hidden and visible costs.

Keywords: Ground Operation, Aircraft Accidents, Equipment's Collision, Risk in the workplace, Human Effective Factors, Environmental Factors.

I.   INTRODUCTION

King Abdul-Aziz International Airport (KAIA) is the international Airport located 19 km to the north of Jeddah. Named in 1981, the airport is the main gate to the two holy Mosques and the largest Airport in the Kingdome. It has more than five Terminals rather than Royal and military. The airport's Hajj Terminal was specially built for Muslim pilgrims going to Makkah on the Hajj & Umrah seasons which this Airport in unique accepting this kind of reasons and high traffic in limit time and special kind of passengers [1-3]. It is one of the largest in the world and can handle 80,000 passengers at the same time in the new Terminal 1, it occupies an area of 105 square kilometers. Nearby the airport proper, includes the royal terminal facilities of King Abdullah Air Base for the Royal Saudi Air Force.

The new King Abdul-Aziz International Airport three-stage development started in 2006 and is currently scheduled for an official opening in last 2019. The expansion includes a brand-new passenger terminal building, a 136-meter tall air traffic control (ATC) tower one of the highest towers in the world, airfield hard-standing and paved areas, lighting, fuel network systems, electronic passenger guidance system and a new storm water drainage network. According to GACA General Authority of Civil Aviation of Kingdome of Saudi Arabia, will be marked by stage capacity increase to 30 million, 60 million and 80 million passengers per year [4-9]. In this study, it consist of General Authority of Civil Aviation (GACA) Airports as part of the Saudi operation daily flight to expose the impact of the aviation safety while reduce and eliminate the events ground incidents happened at the Airport field.

II.   METHODOLOGY

The research design, data collection, variables definition with Measurements, and Hypothesis of the Study will be presented. as below will explain the research design that employed in the study as well as the sampling methodology. the data analysis methods used in the study and covers the methodology used in this research provided from safety department at KAIA available and highlighted in this research for the period 2015 to 2019. The conceptual framework, research approach, target group and sample size, as well as the data collection and analysis methods.

III.   RESULTS AND DISCUSSION

A.   *Non-Aircraft Related Accidents*

During the period of the study (2015- 2019) from Safety department database at the Airport and shown in Table (1) presents the aircraft related events and accidents there is some increase in the number of events somehow in the beginning of the 2017 due to lake of experience to avoid the events then decrease in the years after that   until 2019 with deferent spot in the field operation and the procedure of safety may get more common years and training for staff and keep the work place safely in line with the globally instruction ICAO and quality standards.

Table (1) Events incidents Non- Aircraft Related

Item / Year	Numbers (and share %)					Total
	2015	**2016**	**2017**	**2018**	**2019**	
Total No. Non-Aircraft related events	103	156	222	110	135	1090
GSE Facility	24 (23%)	28 (18%)	31 (14%)	22 (20%)	12 (9%)	117 (16%)
GSE at aircraft	8 (8%)	13 (8%)	17 (8%)	23 (21%)	3 (2%)	64 (9%)
GSE - human	9 (10%)	19 (12%)	41 (18%)	11 (10%)	28 (21%)	108 (15%)
Speeding	3 (3%)	15 (10%)	11 (5%)	5 (5%)	12 (9%)	46 (6%)
Driving w/o license	24 (23%)	32 (21%)	10 (5%)	3 (3%)	2 (1%)	71 (10%)
Smoking	26 (25%)	39 (25%)	92 (41%)	27 (25%)	65 (48%)	249 (30%)
System Failure	2 (2%)	4 (3%)	5 (2%)	8 (7%)	6 (4%)	25 (3%)
Cross Runway	7 (7%)	6 (4%)	15 (7%)	11 (10%)	7 (5%)	46 (6%)
Injuries	24 (23%)	28 (18%)	31 (14%)	22 (20%)	12 (9%)	74 (7%)

The events in the table above may happened during operation of aircraft take-off, taxi, aircraft landing Ground Services Equipment's (GSE) with several causes such as with human, aircraft of facility.
In the field workplace that accidents could happen and with laying the roles and safety instruction can minimize the number of events. Table (1) shows the substantial shares 15%, and range: 18%-21%) of the events happened of the human crash totally 108 in the period with the equipment due to many reasons will list some of it below as the factor at Jeddah Airport.
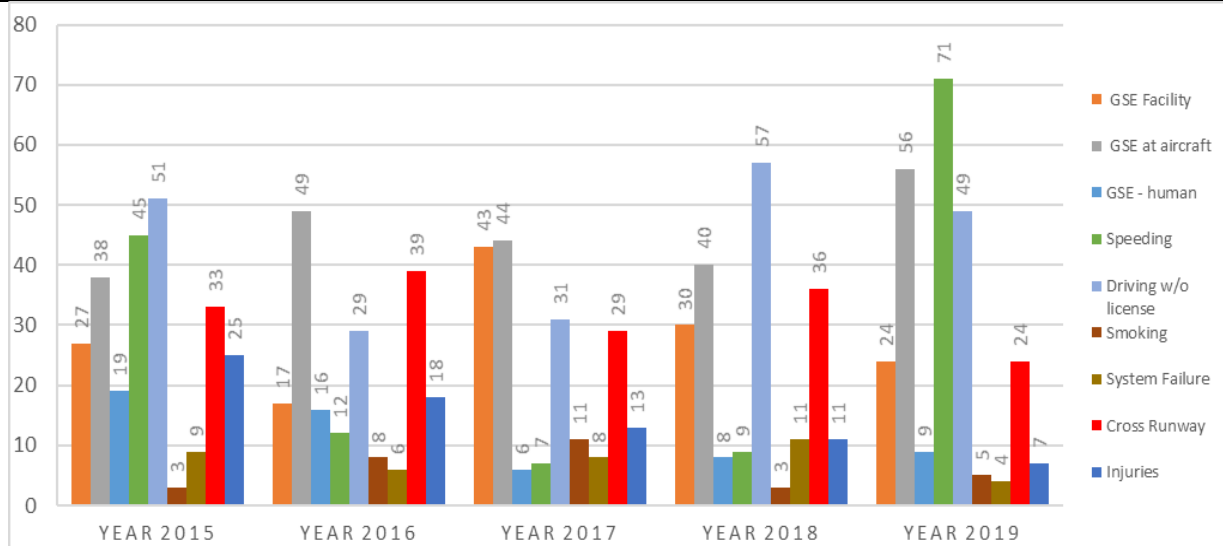
Figure (1) Events and operation incidents Non-Aircraft Related

In the last of 2019 the responsible departments lead to handle many kind of accidents may happen such cross runway or similar with a new roles that could appear minimize the number of events (average 7%, range 4% - 5%) that makes the organization more efficient and high quality to be commercialization in the road map of GACA. The reasons of some events chanced clarify and after using Fishbone analysis in the research were summarize in many points such:

- Lake of awareness, training and supervision or equipment's should be used.
- Fatigue and keeping the workers under pressure more than the limit of working hours.
- Failure to do major maintenance for equipment using in the field and workers PPE.
- Environment factors and whether such as sandstorm or heavy rain.

For these etiologies it was must to study another side of accidents Aircraft related to cover hole picture of the events and to draw guide line decreasing the errors and events at the Airport at all, so it supposes to appointed with the Aircraft related events

B.   *Aircraft Related Accidents*

Whether the case will focus on the main points of the causes of that and some solutions to be avoided also, the table below shows some of the events happened and stored in database of KAIA- GACA safety department and for each accident/incident, about ground path occurred during the same period 2015-2019 during operation of aircraft take-off, taxi, aircraft landing and may match with some of the reasons with Non- Aircraft events It's including Collisions with person, ground vehicle, obstacle, building, structure, etc., but excludes ground collisions resulting from events categorized under Runway Excursion (RE), Ground Handling, its event defined as incidences during or ground handling operations.

Workplace Environment:

As shown for example ground collision statistics 16% in general of the Aircraft related events in year 2015 with share 23% goes gradually and decrease in the year 2019 to 9% and aircraft collision happened due to many reasons:

- No flashing of the working place the runway rubber or such foreign object damage FOD.
- Whether factors such as sandstorm, heavy rain and wind in the Airport air side.
- Lack of interest in the air side workplace and the factors of growing birds and stray animals.
- loss of control or system/component failure or malfunction and in ground hard braking maneuver, rapid change.
- Lack of some real accidents reports and follow up the source of the problem reasons.

Table (2) Events and operation incidents Aircraft Related

| Item / Year	Numbers (and share %)					Total
	2015	2016	2017	2018	2019	
Total No. Aircraft related events	103	156	222	110	135	726
Ground Collision	24 (23%)	28 (18%)	31 (14%)	22 (20%)	12 (9%)	117 (16%)
Aircraft Collision	8 (8%)	13 (8%)	17 (8%)	23 (21%)	3 (2%)	64 (9%)
FOD	9 (9%)	19 (12%)	41 (18%)	11 (10%)	28 (21%)	108 (15%)
Bird Strike	3 (3%)	15 (10%)	11 (5%)	5 (5%)	12 (9%)	46 (6%)
Defunct systems	24 (23%)	32 (21%)	10 (5%)	3 (3%)	2 (1%)	71 (10%)
Abrupt Maneuver	26 (25%)	39 (25%)	92 (41%)	27 (25%)	65 (48%)	249 (30%)
Fall Slippery Apron	2 (2%)	4 (3%)	5 (2%)	8 (7%)	6 (4%)	25 (3%)
Runway Excursion	7 (7%)	6 (4%)	15 (7%)	11 (10%)	7 (5%)	46 (6%)
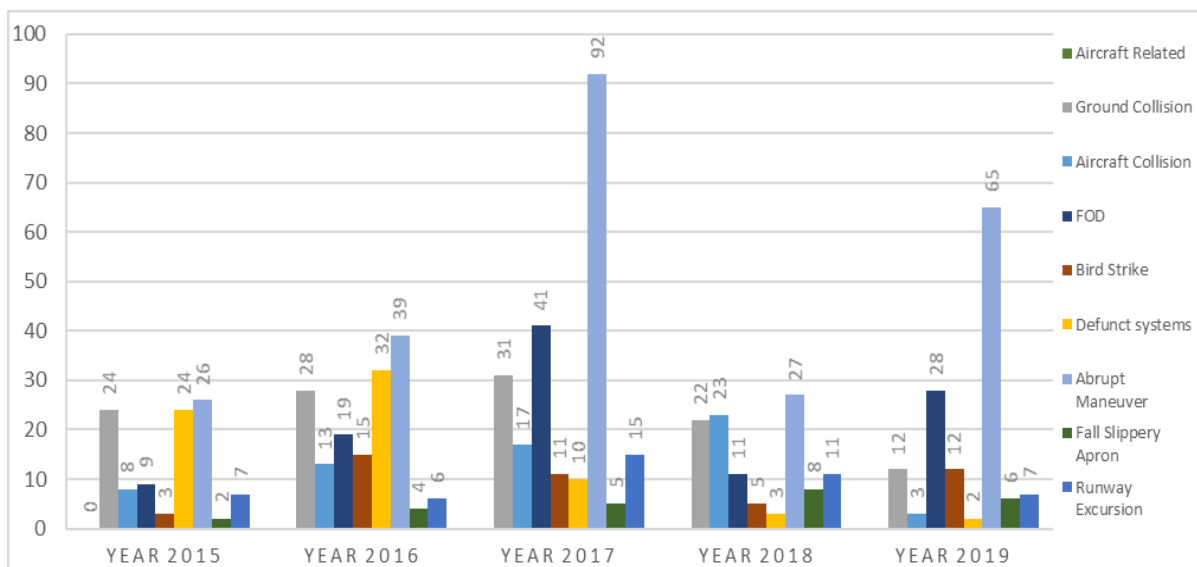
Figure (2) Events Aircraft Related

Runway Excursion is a veer off or overrun from the runway surface share 7% totally with several spike in the deferent period mentioned especially in year 2018 with 8% due to high traffic in Hajj and umrah seasons. These surface events occur while an aircraft is taking off or landing, and involve many factors ranging from unstable approaches to the condition. It can occur on takeoff and landing. consist of two types of events veer-off and overrun.

Vehicle and Aircraft:

The most important is equipment the vehicle or tools using in the field of air side handling the aircraft for many purposes of cargo, luggage and ground services. For example, brake failure, wheels failure or high speed that effect the aircraft fall on slippery Apron (average: 3% range: 2%- 4%). It should be under control with continues services from the operator responsible and got the license and the safety instruction with highly quality leading with the Airport and GACA goals.

Communication and Reporting:

As mentioned, before it's very important to reporting of the main act and accidents report with highly communication with the manner departments and supervisions with tracking the events and root cause analysis for each problem to avoid it (average:16%, range: 23% - 9%) of share Aircraft accidents happened with these reasons.

Supervision and Training:

It's very important the training side at any organization avoiding the errors could happen to reduce cost and failure and many accidents causes happened with this manner lack of Implementing SOPs, fatigue and not instruct safety distance in the field.

Surface conditions and Maintenance:

The most famous problem FOD foreign object damage with (average:15%, range: 9% - 21%) it could cause damage of the equipment and aircraft produce the accidents in the field such rubber, plastic or any other things on the surface and with maintain the equipment that could cleaning It contributes to reducing accidents as shown in the statistics after paying attention to this important point and This is one of the most important reasons for this study due to the high statistics of this type of causes and some causes of failure to maintenance were:

- Loss of runway lights
- Runway undulation
- FOD

IV.   CONCLUSION

In This paper the main purpose to declare the most events of the accidents of aircraft and non-aircraft deferent causes of accidents for the period 2015 – 2019 we split with ground operation involves all aspects of aircraft handling at airports as well as aircraft movement around the aerodrome, safety challenges of ground operations and the preparation of aircraft for departure in such a way that the successive flight will be safe correct aircraft loading , adequate and verified fuel quantity with meeting quality management for all category and sectors of the work field and output to achieve overall the quality and safety in the work place we propose accident analysis methodology consisting of :

- Data collection

- Root cause analysis method

- Data Analysis

The most effective ground accidents events happened usually and appropriate solutions for KAIA incidents and accidents that average of 35% of the accidents. Eliminating or reducing the aviation and ground incidents that eventually affect the workers and agency with average of 42% of ground operation.

Above mentioned concentrated on hidden coast naturally before other coast that effective for commercialization for Airport and Kingdome od Saudi Arabia vision 2030.

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Ethical statement: The authors declare that they have followed ethical responsibilities

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