Department of Industrial and Systems Engineering

IE3100R Systems Design Project

Time-Motion Study For Airport Process

About CAAS

The Civil Aviation Authority of Singapore (CAAS) is a Statutory Board under the Ministry of Transport. CAAS' roles are to enable the growth of the air hub and aviation industry, oversee and promote safety in the industry, provide air navigation services, and develop Singapore as a centre of excellence for aviation knowledge and human resource development.

Project Objectives

1. Find out the manpower deployed, time taken, and number of man-hours used at key processes in the areas of baggage handling, passenger handling and ramp handling
2. Identify opportunities where certain processes can be streamlined or eliminated for process efficiency
3. Develop a methodology to calculate productivity output figures from the manpower deployed, time taken, and number of man-hours data collected.

The 3 Targeted Airport Processes

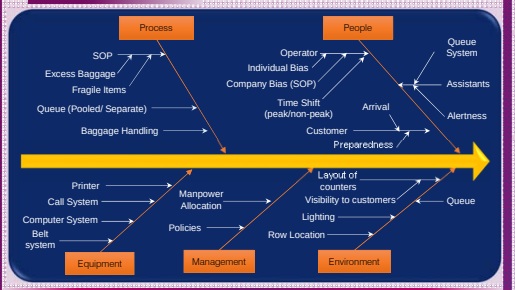
Passenger Departure Check-in

Definition: The whole procedure for passengers to check in at the check-in counters before departure

Process Flow

Join Queue → Exit Queue to Enter Counter → Start of Check-In Service → Leave the Check-In Counter

Ishikawa Diagram



Constraints Derived from Stakeholders' Requirements

1. Limitations in influencing manpower allocation system due to contractual requirements
2. Balancing of manpower productivity with customer experience

Methodology

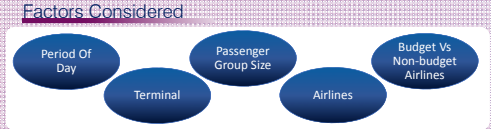
Operator Level Improvements | Identifying Possible Areas Of Improvement | Stratify Data To Mitigate Issue Of High Variability

KPI: Service time per customer

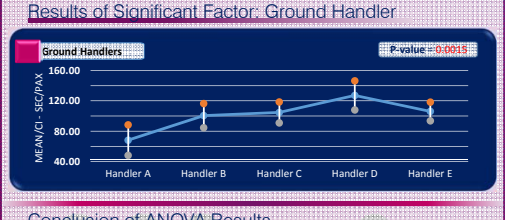
Usage of ANOVA

- To identify most significant sources of variation
- Use as basis for identification for areas of improvement

Factors Considered



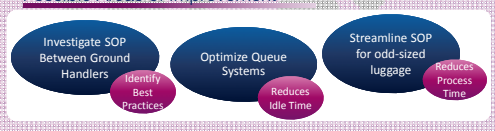
Results of Significant Factor: Ground Handler



Conclusion of ANOVA Results

1. Ground Handler is a statistical significant source of variation in check-in processing times.
2. Effect of other factors on check-in processing time is not statistically significant

Possible Areas of Improvement



Recommended Methodology for Follow Up Studies

1. Repeated tracking of service time stratified by significant factors across years
2. Implement system to track service time via automation

Departure Baggage Handling

Definition: The departure baggage handling process to sort and transfer baggage from the race tracks to their respective dollies before being loaded onto their flights

Process Flow

Baggage Released from Early Baggage Storage and Check-In → Goes through multiple layers of Security Checks → Sorted into Designated Race Tracks → Handlers Scan and Load Baggage onto Dollies

Constraints Derived from Stakeholders' Requirements

1. System-level approach adoption due to simple sub-processes
2. Improvements should require minimal disruptions of baggage handling operations

Proposed Methodology

Use benchmarking for KPI value based on output/input

Derive Productivity | Identify optimal scenario as benchmark | Derive the utilisation via Benchmark

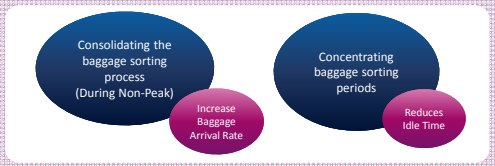
$$\text{Proxy for Utilization(KPI)} = \frac{\frac{Bags}{0.5\ man-hour}@non-peak}{\frac{Bags}{0.5\ man-hour}@peak}$$

- **Optimal value of KPI = 1, and this can be achieved by**
  - Adjusting arrival rate of baggage during non-peak periods to simulate peak periods
  - Adjusting manpower allocation system during non-peak periods to reduce idle time of operators

Advantages

1. Provides an optimal benchmark or situation to achieve, without crippling process capability especially since it is a critical airport process
2. Data is readily available for stakeholders, and requires little extra effort to collect data required

Possible Areas of Improvement



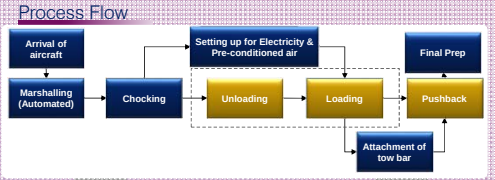
Recommended Methodology for Follow Up Studies

1. Repeated tracking of Utilization Proxy across years to track efficacy of improvement measures
2. Implementation of IT system to facilitate Utilization Proxy tracking to allow real time tracking and improvements

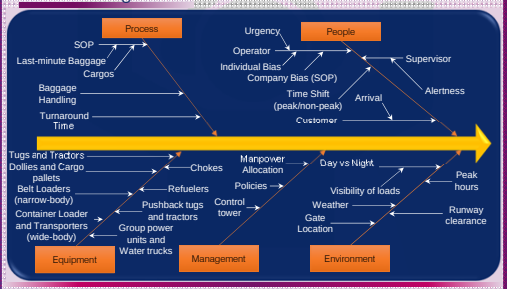
Ramp Handling

Definition: All processes required for a passenger aircraft turnaround, from the point of the required ground preparation before an aircraft arrives at a contact stand of the airport terminal, to the point that it departs

Process Flow



Ishikawa Diagram



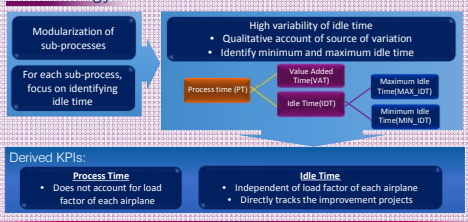
Constraints Derived from Stakeholders' Requirements

1. Lack of ample data size for statistical analysis due to the absence of IT support
2. Limitation in influencing several sources of idle times due to the interaction of ramp's processes with other systems

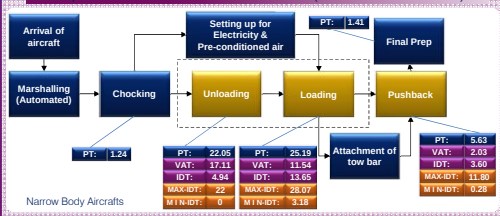
Initial Observation and Challenges

1. Difficulty in tracking manpower roles due to their cross-functionality
2. Lack of layover information which affects process times
3. Limited access to areas for observation

Methodology



Example of Modified Process Flow (With Data in mins)



Potential Sources of Idle Time:

Unloading	Loading	Pushback
Waiting for empty cargo dollies	Waiting for cargo/baggage to arrive	Waiting for pilot's cue to start pushback (i.e. clearance from control tower)
Transfer of unloading equipment between hatch doors (only 1 equipment was used at times)	Waiting for last minute baggage	
	Dependent on turnaround timing (Work attitude varies)	

Recommended Methodology for Follow Up Studies

1. Repeated tracking of process time and idle time stratified by significant factors across years
2. Improve accuracy of the study with more flight data
3. Larger data size will allow for further stratification to perform more in-depth analysis such as ANOVA

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