**KPI Overview for Baggage Delay Prediction System**

**1. Arrival Baggage Delivery Time**

* **Definition:** Time from aircraft block-in to last bag delivery at belt
* **SLA Target:** 90% of bags ≤ 30 minutes
* **AI/ML Role:** Predict delays based on arrival load and crew data

**Key Data Columns:**  
Flight\_Number, Aircraft\_Block\_In\_Time, Last\_Bag\_Delivery\_Time,  
Belt\_Assigned, Ground\_Crew\_Assigned, Number\_of\_Bags  
*Optional:* First\_Bag\_Delivery\_Time, Belt\_Occupancy\_Status

**Constraints & Derived Features:**

* Delivery Time = Last\_Bag\_Delivery\_Time – Aircraft\_Block\_In\_Time
* SLA threshold: ≤ 30 mins
* Engineered: Delivery\_Duration\_Minutes, Belt\_Utilization\_Index

**Missing Fields:**  
Gate\_Position, Weather\_Condition\_at\_Arrival

**2. Departure Baggage Load Time**

* **Definition:** Time from check-in to baggage loaded on aircraft
* **SLA Target:** 100% loaded ≥ 15 mins before scheduled departure
* **AI/ML Role:** Monitor team efficiency and peak patterns

**Key Data Columns:**  
Passenger\_ID, Bag\_Tag\_ID, Checkin\_Time, Bag\_Loaded\_on\_Aircraft\_Time,  
Flight\_Scheduled\_Departure\_Time, Load\_Team\_Assigned,  
Bag\_Routing\_Status, Bag\_Screening\_Status

**Constraints & Derived Features:**

* Calculate Bag Load Lead Time: = Flight\_Scheduled\_Departure\_Time - Bag\_Loaded\_on\_Aircraft\_Time Format as minutes or time duration.
* Identify Late Loads: Flag if Bag\_Loaded\_on\_Aircraft\_Time is <15 mins before departure.
* Create a Stacked Chart: On-time vs. late bags per flight.
* Pivot by Counter Location: See which counters have shorter lead times or trolley gaps.

**Missing Fields:**  
Check-in\_Counter\_Location, Trolley\_Turnaround\_Time

**3. Mishandled Baggage Rate**

* **Definition:** Bags mishandled per 1,000 passengers
* **SLA Target:** < 5 / 1000 pax
* **AI/ML Role:** Pattern detection in mishandling types

**Key Data Columns:**  
Bag\_Tag\_ID, Passenger\_ID, Flight\_Number, Delivery\_Status,  
Mishandling\_Type, Claim\_Category, Baggage\_Claim\_Submitted

**Constraints & Derived Features:**

* **Mishandled Baggage Rate Calculation**: = (Number of mishandled bags / total passengers) × 1000
* **Delivery Delay Minutes**: = Final\_Delivery\_Time – Passenger\_Arrival\_Time (when applicable)
* **Sensor Trace Analysis**: Flag missing or partial sensor data to identify tracking gaps
* **Transfer Risk**: Bags with ≥1 transfer count have increased mishandling probability
* **Engineered**: Delivery\_Delay\_Minutes, Bag\_Trace\_Timeline

**Missing Fields:**  
Transfer\_Flight\_Count, Baggage\_Tracking\_Sensor\_Data

**4. Transfer Baggage SLA Compliance**

* **Definition:** % of transfer bags delivered within Minimum Connection Time (MCT)
* **SLA Target:** > 99.5% compliance
* **AI/ML Role:** Predict risk of missed connections and rerouting needs

**Key Data Columns:**  
Bag\_Tag\_ID, Inbound\_Flight\_Number, Outbound\_Flight\_Number,  
Inbound\_Arrival\_Time, Outbound\_Departure\_Time, Airport\_MCT\_for\_Transfer

**Constraints & Derived Features:**

* Calculate Transfer Buffer: Outbound\_Departure\_Time – Inbound\_Arrival\_Time
* Check SLA Compliance: Is buffer ≥ MCT and bag loaded on time?

**Visualize Risk Factors:**

* Scatter plot: MCT vs Actual Transfer Time
* Engineered: Bag\_Transfer\_Time, Transfer\_Buffer\_Minutes

**Missing Fields:**  
Gate-to-Gate\_Distance, Transfer\_Path\_Type (Auto/Manual)

**5. Baggage System Downtime**

* **Definition:** Time lost due to BHS or belt incidents
* **SLA Target:** < 10 minutes per failure event
* **AI/ML Role:** Detect incident clusters, alert maintenance early

**Key Data Columns:**  
System\_ID, Incident\_Start\_Time, Incident\_End\_Time, Incident\_Type,  
Maintenance\_Team\_Response\_Time, Location\_Affected

**Constraints & Derived Features:**

* **Duration Calculation**: =End\_Time – Start\_Time Format as time difference in minutes.
* **MTTR (Mean Time To Repair)**: Average incident duration across rows

**Visuals to Create**:

* Column chart: Downtime per incident type
* Radar chart: MTTR by location
* Line chart: Weekly incident frequency
* Engineered: Mean\_Time\_To\_Repair (MTTR), Incident\_Frequency\_Per\_Week

**Missing Fields:**  
Root\_Cause\_Code, Sensor\_Logs\_During\_Incident

**6. Baggage Damage Rate**

* **Definition:** % of bags reported damaged or claimed
* **SLA Target:** < 1% per 1000 bags
* **AI/ML Role:** Identify handling zones linked to repeated damage

**Key Data Columns:**  
Bag\_Tag\_ID, Damage\_Reported\_Flag, Damage\_Claim\_Type,  
Damage\_Reported\_Time, Flight\_Number, Zone\_of\_Damage

**Constraints & Derived Features:**

* Time to Report Calculation: = Damage\_Reported\_Time – Flight\_Arrival\_Time (formatted as minutes)
* Zone Analysis: Filter by Zone\_of\_Damage to count repeat incidents
* Damage Rate Calculation: = (Damaged Bags / Total Bags per Flight) × 1000
* Valid if Damage Reported ≥ Flight Arrival Time
* Engineered: Time\_To\_Report\_Damage, Repeat\_Zone\_Incidents

**Visuals to Create:**

* Stacked Bar: Damage by claim type
* Heatmap: Frequency by zone
* Line Chart: Damage trends by baggage type

**Missing Fields:**  
Baggage\_Type, Handling\_Camera\_Footage\_Timestamps

**Final Summary Table**

| **KPI** | **Key Columns** | **Constraints / Derived** | **Missing / Suggested Fields** |
| --- | --- | --- | --- |
| Arrival Delivery | Block-in, Bag Time, Belt | ≤30 mins delivery, Utilization Index | Weather, Gate Position |
| Departure Load Time | Check-in, Bag Load Time | ≥15 mins before dep, Late Load % | Trolley timing, Counter location |
| Mishandled Rate | Bag ID, Status, Claim Submitted | <5/1000, Delay Minutes, Trace Path | Transfers, Sensor data |
| Transfer SLA Compliance | Arrival/Departure Times, MCT | ≥99.5%, Buffer ≥ MCT | Gate Distance, Transfer Path Type |
| System Downtime | Incident Times, Type, Location | <10 mins/event, MTTR, Frequency | Root Cause Codes, Sensor Logs |
| Damage Rate | Damage Flag, Report Time, Zone | <1%, Time to Report, Repeat Cases | Bag Type, Footage Timestamps |

| **KPI** | **Key Data Columns** | **AI/ML Role** |
| --- | --- | --- |
| Arrival Delivery | Flight#, Block-In Time, Bag Delivery Time | Predict delays, crew availability |
| Departure Load Time | Passenger ID, Check-in & Load Time | Monitor efficiency & peak patterns |
| Mishandled Rate | Bag ID, Status, Claim Submitted | Detect mishandling patterns |
| Transfer SLA Compliance | Bag ID, Inbound/Outbound Flight, MCT | Predict missed connections |
| System Downtime | System ID, Incident Times, Type | Detect incidents & alert |
| Damage Rate | Bag ID, Damage Flag, Report Time | Identify damage zones |