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AUTO MECHANISM FOR ELIMINATING SAFETY INCIDENTS DURING PBB TUNNEL ROPE FAILURE

"DARE TO TRY CATEGORY"

Presented By: Engineering & Technical Services

Date:12.01.2021

GMR

MISSION STATEMENT

To implement Auto Mechanism for safety of passenger boarding bridges during tunnel rope fail.

PASSANGER BOARDING BRIDGE

- PBBs are used in airport for passenger safe boarding and De-boarding in all weathers condition.
- PBB tunnels is designed with telescopic mechanism to have safe extension and retraction during operation.
- PBBs are provided to reduce traffic movement on the apron area.
- PBB's are used as pathway by passenger's from terminal to aircraft and vice versa.

INTRODUCTION OF PBB OPERATION

- ✓ PBB's Will be extended and retracted during operations and it is guided by rollers and balanced by steel ropes.
- ✓ Passenger boarding bridges are fasten with a two steel ropes to guide the tunnels during PBB extension and retraction.
- ✓ These steel ropes plays a crucial role during the bridge movement.

PBB comprises of multiple tunnels whose movement is balanced by tunnel ropes.

Following are the risks involved in Operations :-

1) Steel rope cut

2) Operational Errors

The above rope damage risk is a challenging issue cannot be predicted by operator during operation.

PROJECT PROCLAMATION

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Project Definition | Diagnostic Journey | Remedial Journey | Holding The Gains

Steel Rope in Good Condition

Steel Rope in Damaged Condition

ROPE FAILURE

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- ✓ During our regular inspection it is observed that some of the rope strands of the steel rope are got cut which will results in reduction in strength of steel rope and this will be replaced during regular maintenance.
- ✓ If the strength of the rope gets impact and result in wear and tear condition it leads to a major safety impact.
- ✓ To eliminate this probability of negligence a team is formed to explore a auto mechanism solution

Rope in good condition

Rope stands got cut

MAJOR IMPACTS OF ROPE FAILURE

PBB Tunnels are connected with steel ropes which is balancing the tunnel movement during extension and retraction of PBB.

In case rope cut during operation the speed of the tunnel will be uncontrolled which may lead to major incident and resulting in damage of PBB or Aircraft.

Collapse of PBB

Scratches in Aircraft

Tunnel glass Damage

TEAM CONSTITUATION

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Team Mentor	JAYARAJU
Team Leader	GUNASEKAR
Team	MAQBUL AHMAD TOSIP PAUL R HARIHARA GOPI KUMAR PAWAN JOYISH

INITIAL PLAN

Project Analysis: To avoid any operation related accident in PBB due to rope damage

Task Deployment: Team Brain Storming and team work, Solution identification and implementation

EVALUATION: To provide safety and no hampering of operations

DESIGN: Project to be designed by considering safety, easy for operation and no major modification in PBB which will affect the design.

IMPLEMENTATION & TESTING: Initial plan with target date will be prepared and based on that implementation and testing will be done.

ACTIVITY PLAN (TIMELINE)

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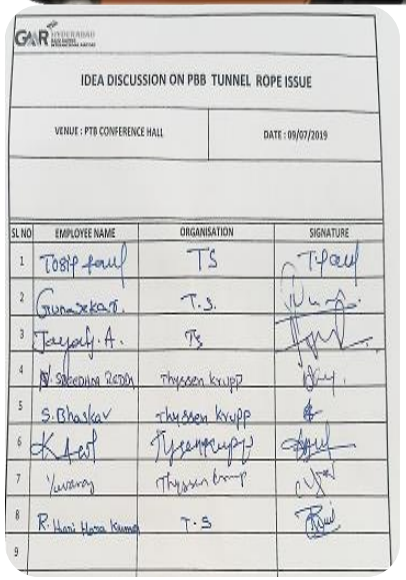
S #	ACTIVITY	RESP	MONTH: JUL-2019				MONTH:AUG-2019				MONTH:SEP-2019				REMARKS
			I	II	III	IV	I	II	III	IV	I	II	III	IV	
1	Brain Storming	PLAN													
		ACTUAL													
2	Collection of Ideas with Effective Analysis	PLAN													
		ACTUAL													
3	Finalization of Solution	PLAN													
		ACTUAL													
4	Arrangement of Materials/Spares	PLAN													
		ACTUAL													
5	Implementation &Commissioning	PLAN													
		ACTUAL													
6	Result Analysis	PLAN													
		ACTUAL													

Plan Actual

TEAM PARTICIPATION

IDEA DISCUSSION ON PBB TUNNEL ROPE ISSUE		
#	AGENDA	DATE
1	BRAIN STORMING SESSION 1	5/7/2019
2	BRAIN STORMING SESSION 2	11/7/2019
3	DISCUSSION ON COLLECTION OF IDEAS	16/7/2019
4	DISCUSSION ON FINALIZATION OF SOLUTION	9/8/2019
4	DISCUSSION ON ARRANGEMENT OF MATERIALS/SPARES	17/8/2019
6	RESULT ANALYSIS	20/9/2019



IDEA DISCUSSION ON PBB TUNNEL ROPE ISSUE

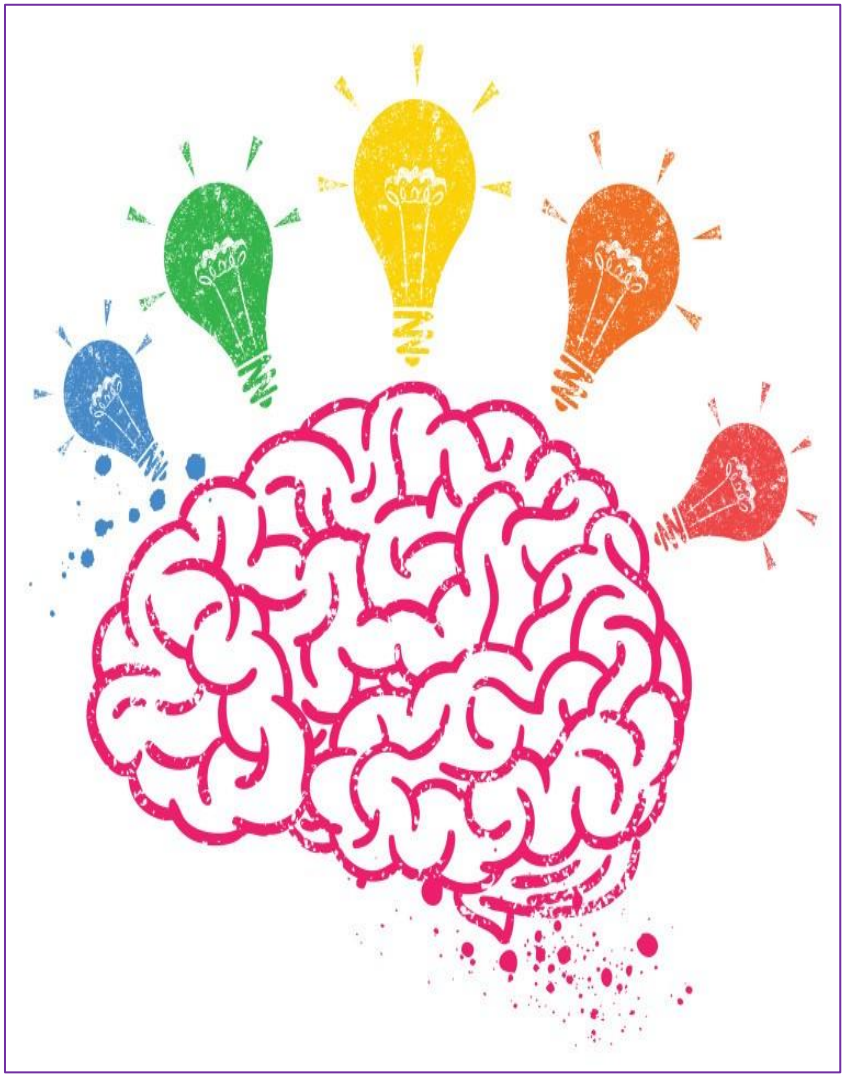
VENUE : PTB CONFERENCE HALL | DATE : 09/07/2019

SL NO	EMPLOYEE NAME	ORGANISATION	SIGNATURE
1	Tosif Faruk	TS	
2	Gunasekar.	T.S.	
3	Jayaraj. A.	TS	
4	[illegible]	Thyssen krupp	
5	S.Bhaskar	thyssen krupp	
6	[illegible]	[illegible]	
7	[illegible]	[illegible]	
8	[illegible]	T.S	
9			

BRAIN STORMING

Criteria decided by the team for Project

1. Safety of Passenger
2. Safety of Aircraft
3. Proactive Approach
4. Ease of operation.
5. Easy installation
6. Without disturbing the OEM design
7. Using in-house materials
8. Low cost



IDEAS FROM BRAIN STORMING

- Replacing rope guide with mechanical support.
- Additional rope for tunnel supporting
- Installation of Mechanical stopper for tunnel supporting rope abnormalities.
- Provision of alert system to operator.
- Controlling the tunnel movement through PLC logics during rope failure..
- Installing Brake system to minimize impact during rope damage
- Replacing Ropes proactively on defined time

PROJECT OBJECTIVE

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TO INSTALL MECHANICAL STOPPERS BETWEEN TUNNELS

- In PBB existing tunnel has side bars with holes.
- Planned to fix the mechanical stoppers in these side bars.
- Hence decided to move forward on this with internal service provider teams.
- To reduce the mechanical impact during rope failure.

PROJECT IMPLEMENTATION

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SIDE BARS

STOPPER

FIXING STOPPER

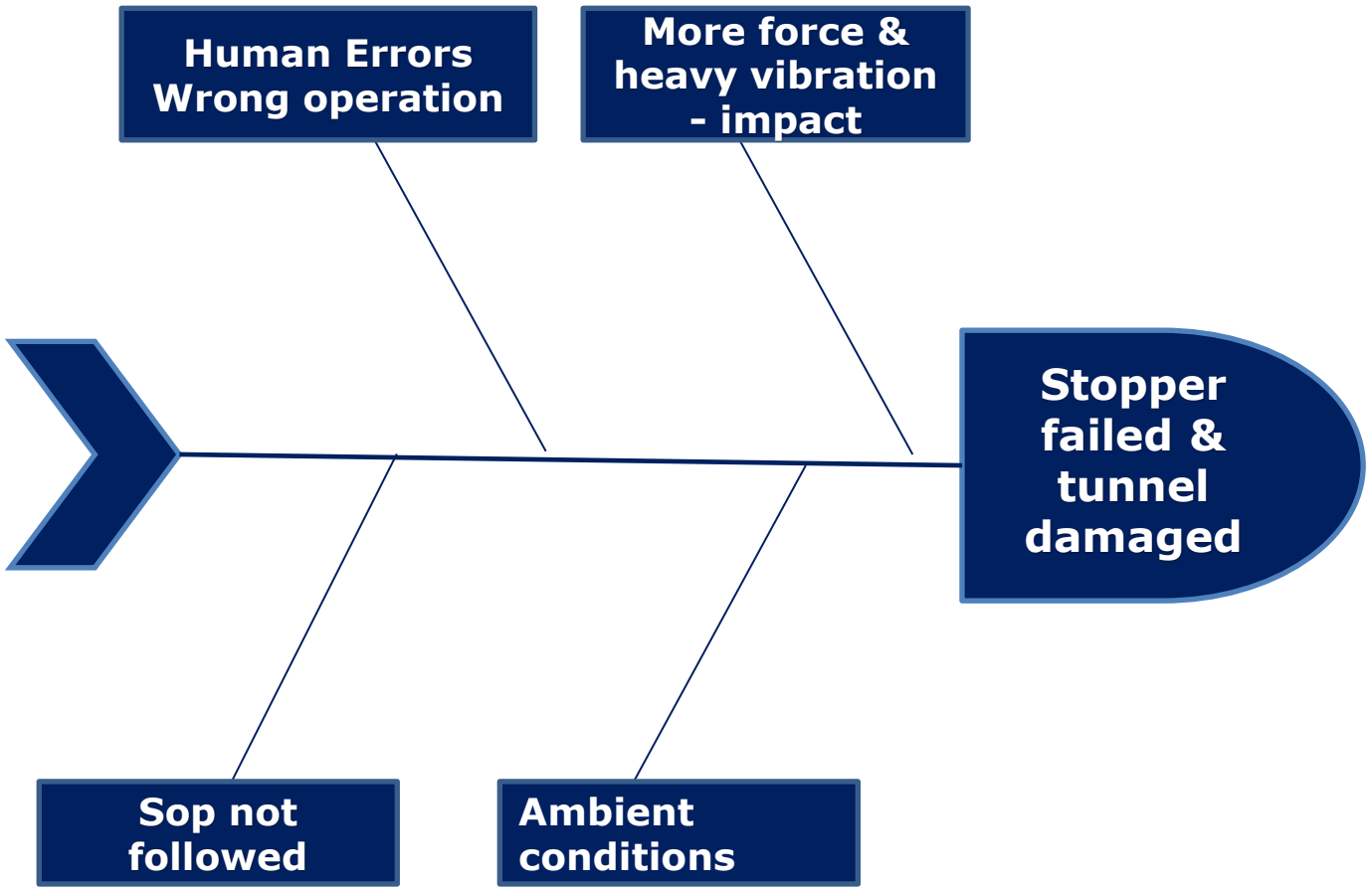
STOPPER FIXED

TRIAL SIMULATION

IDEA UNSUCCESSFUL

GLASS DAMAGE

CAUSES & EFFECT ANALYSIS



FAILURE MODE EFFECTIVE ANALYSIS

FAILURE MODE EFFECTIVE ANALYSIS(FMEA)				
Equipment Name	Passenger Boarding Bridge		Date:20.09.2019 Rev:1	
Failure Mode	A) Severity Rate 1-10 (10 is most severe)	B)Probability of Occurrence Rate 1-10 (10 is most severe)	C)Probability of detection Rate 1-10 (10 is least severe)	Risk Performance Number(RPN) A*B*C
Strength of the stopper less	7	3	5	105
Stopper not fixed properly	8	3	4	96
Heavy force and vibration	9	9	2	162
Operator Error	3	4	7	84
Ambient condition	5	3	3	45

From the above FMEA analysis it was concluded that stopper idea was unsuccessful mainly due to more force and heavy vibration occurred during tunnel got unbalanced due to rope failure.

LEARNINGS

- Stoppers strength is not sufficient to control the tunnel force.
- There is no feasibility to fix stronger stoppers.
- Due to heavy force and vibration during the uncontrollable movement of tunnel the equipment damage is high.
- As the force cannot be controlled it is required to prevent the tunnel movement itself once the rope damages.
- Tunnel movement can be prevented only if the operator gets alert before rope gets damaged.
- Once the operator gets the alert he can either stop the operation or adjust the bridge height accordingly to prevent the tunnel movement due to rope damage.

IDEAS FROM LEARNINGS

- Additional rope for tunnel supporting
- Replacing Ropes proactively on defined time
- Provision of alarm system to alert the operator.
- Controlling the tunnel movement through PLC logics during rope failure..
- Installing Brake system to minimize impact during rope damage
- Regular inspection of ropes by operator before every operation

INSTALLATION OF ALARM SYSTEM

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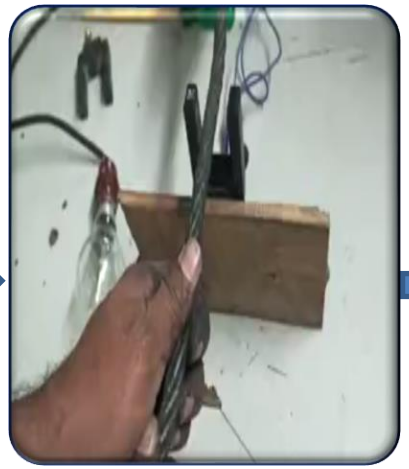
ROPE

SENSOR



SENSOR OPERATION

SENSOR FIXING

SENSOR FIXED

RELAY & LAMP

TRIAL SIMULATION

IDEA SUCCESSFUL

WAY FORWARD

Coordinating with OEM to use the feedback from sensor through PLC to control the PBB tunnel once any sort of abnormality is observed in the Rope.

HOLDING THE GAINS

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PROACTIVE APPROCH

Team Work

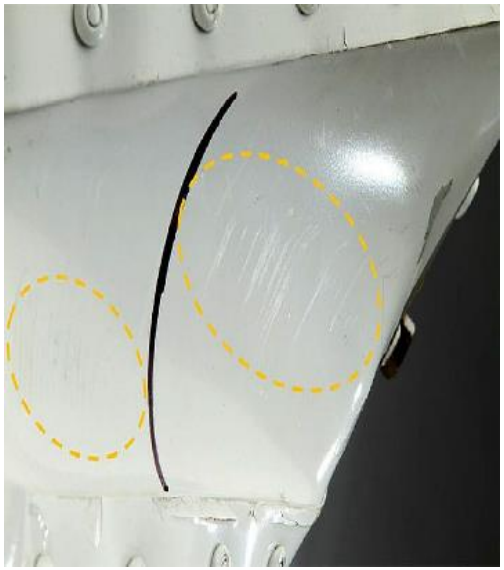
Problem Solving Skills

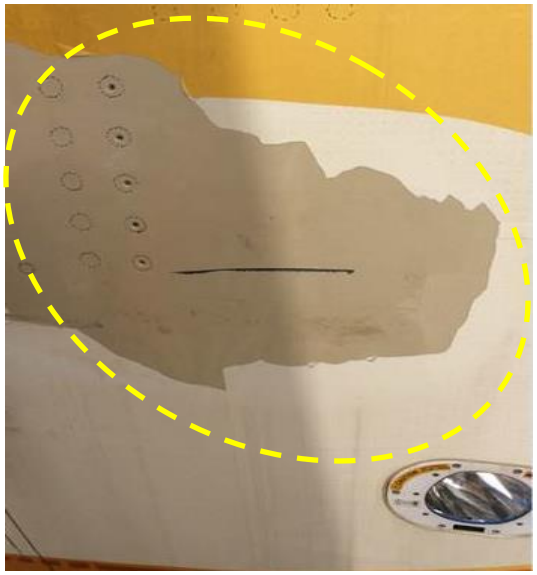
Improving In-house resource capabilities

Safety

Zero Investment

TANGIBLE BENEFITS





Major Benefit is the probability of PBB hitting/Creating scratches in aircraft will be reduced which might leads to major safety incident moreover the charges /penalty the airlines providing to airport operator also neglected because the penalty will be in billions which cannot be measurable.

THANK YOU