Asset management strategies

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GM CRIS

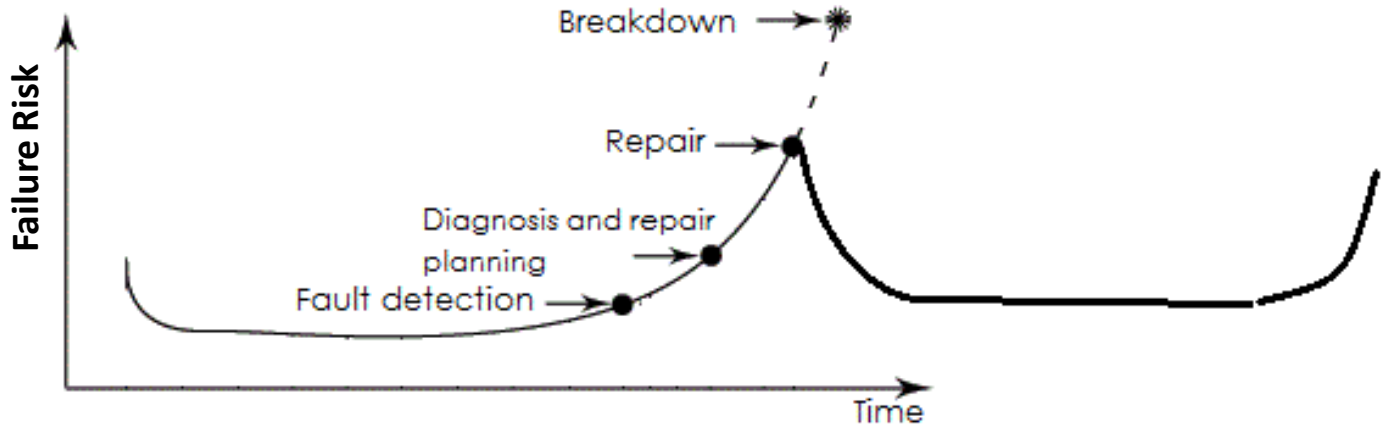
Outline

- Asset Management-Maintenance Philosophy
- Block management system
- Some Best practices

Asset Management

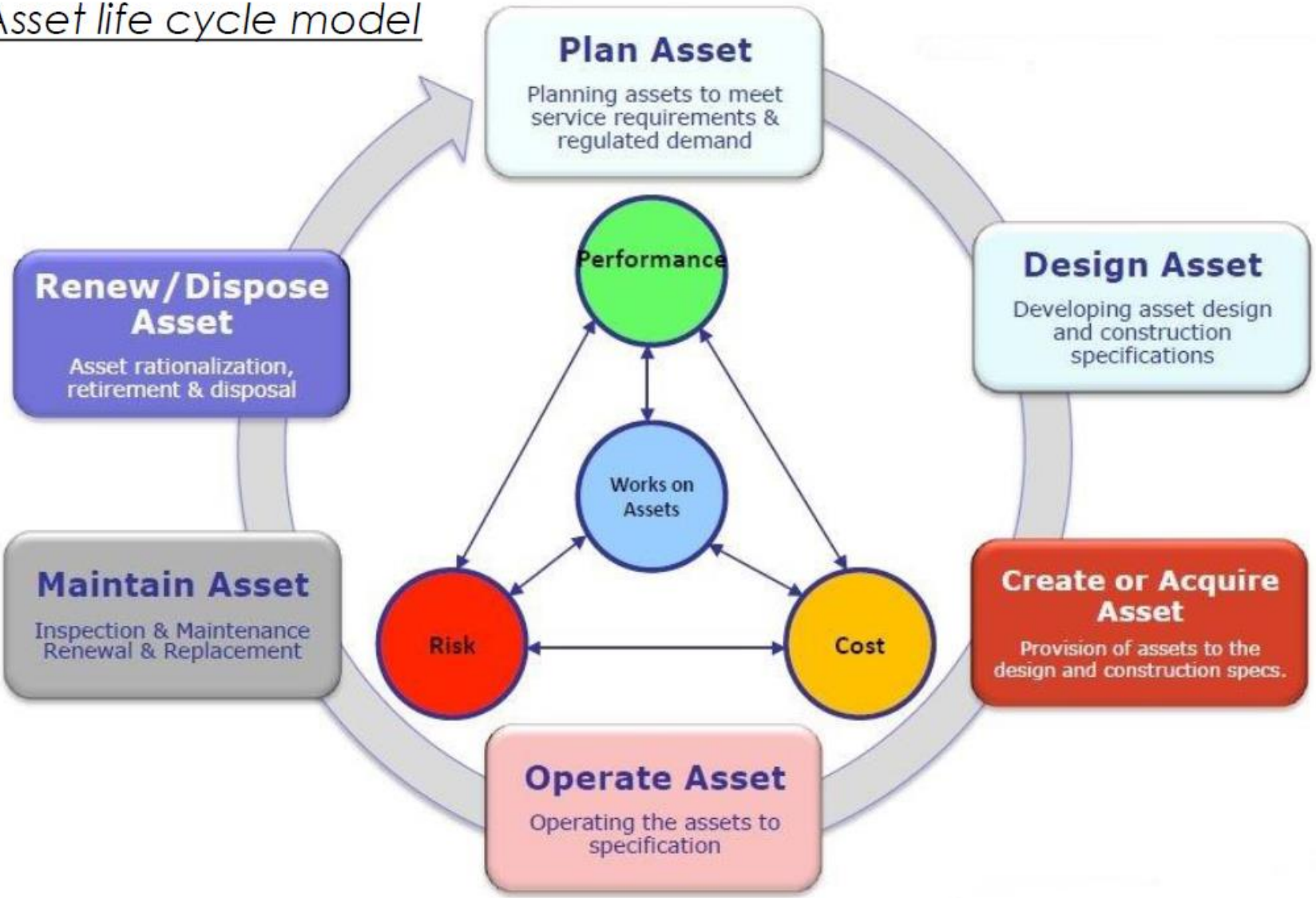
A physical item that has a value to the organization and has a specific function, location and unique identification; for example a track, rolling stock, OHE, lift, escalator, bridge, road section, pump, vehicle, etc.

- Why bother?
- All assets affected over time > reliability loss
  - Wear and tear
  - Weather impact (temperature, humidity, UV..)
  - Vibration
  - Friction
  - Obsolescence
  - Material damages (accidents, vandalism…)



Source: Oscar Sbert Lozano& Laurent Dauby, UITP

Asset life cycle model



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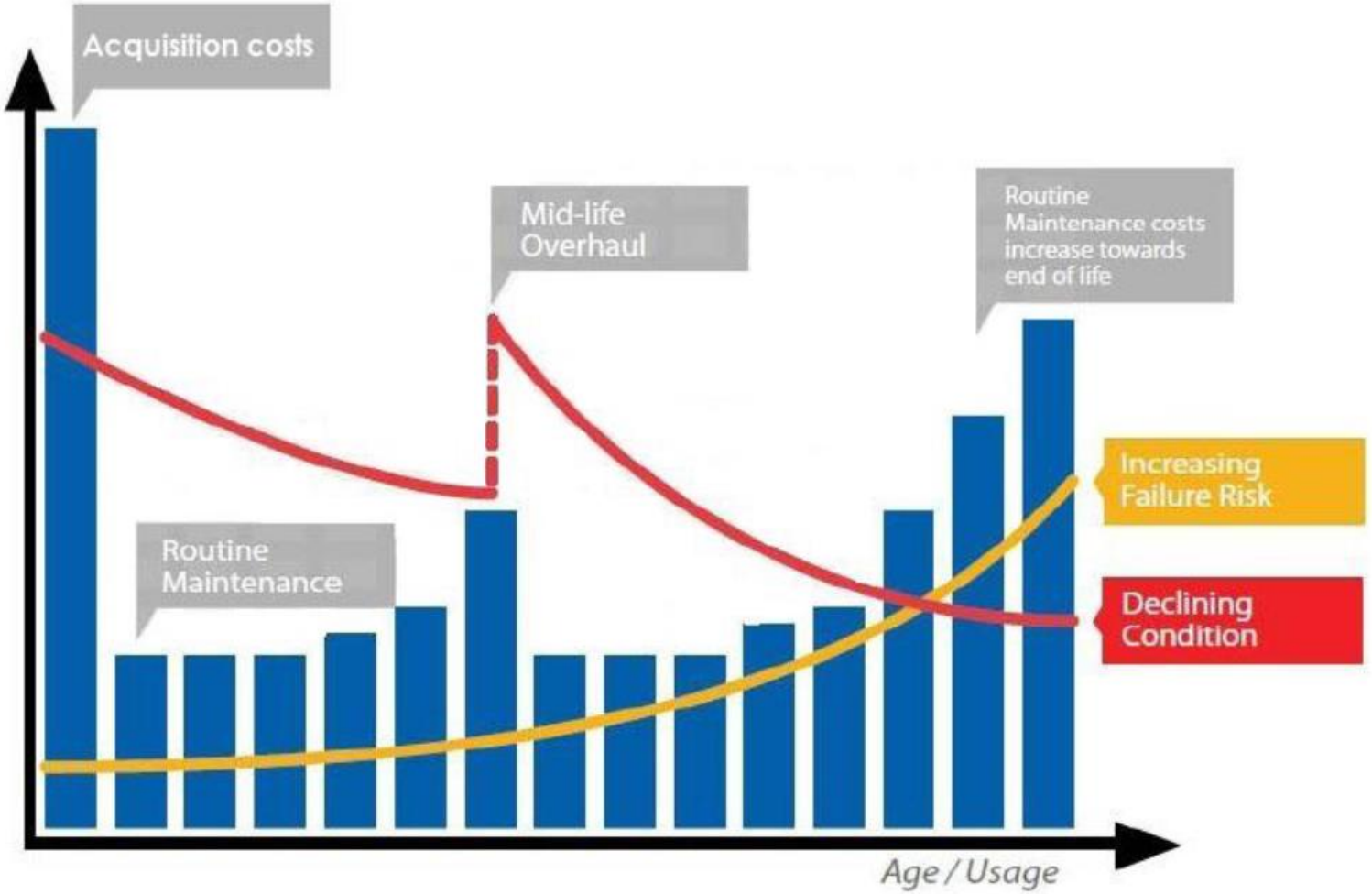
Strategic management to balance conflicting drivers: performance - costs – risks



Source: Oscar Sbert Lozano& Laurent Dauby, UITP

Asset Management

- Systematic and coordinated activities and practice through which an organization optimally manages its assets and their associated performance, risks and expenditures over their lifecycle for the purpose of achieving its strategic plan
- The process spans over: deploying, operating, monitoring, maintaining, upgrading and disposing of a company's assets
- It serves a double objective:
  - Cost-effective for the operator
  - Quality of service for customers

Issues-Metro O&M

- Extensive use of assets
- No maintenance opportunity available during day time
- One-third of O&M Cost for maintenance
- Persistent demand to increase the revenue hours to cater to the commuters in early morning and late-night hours.

Maintenance is must else…

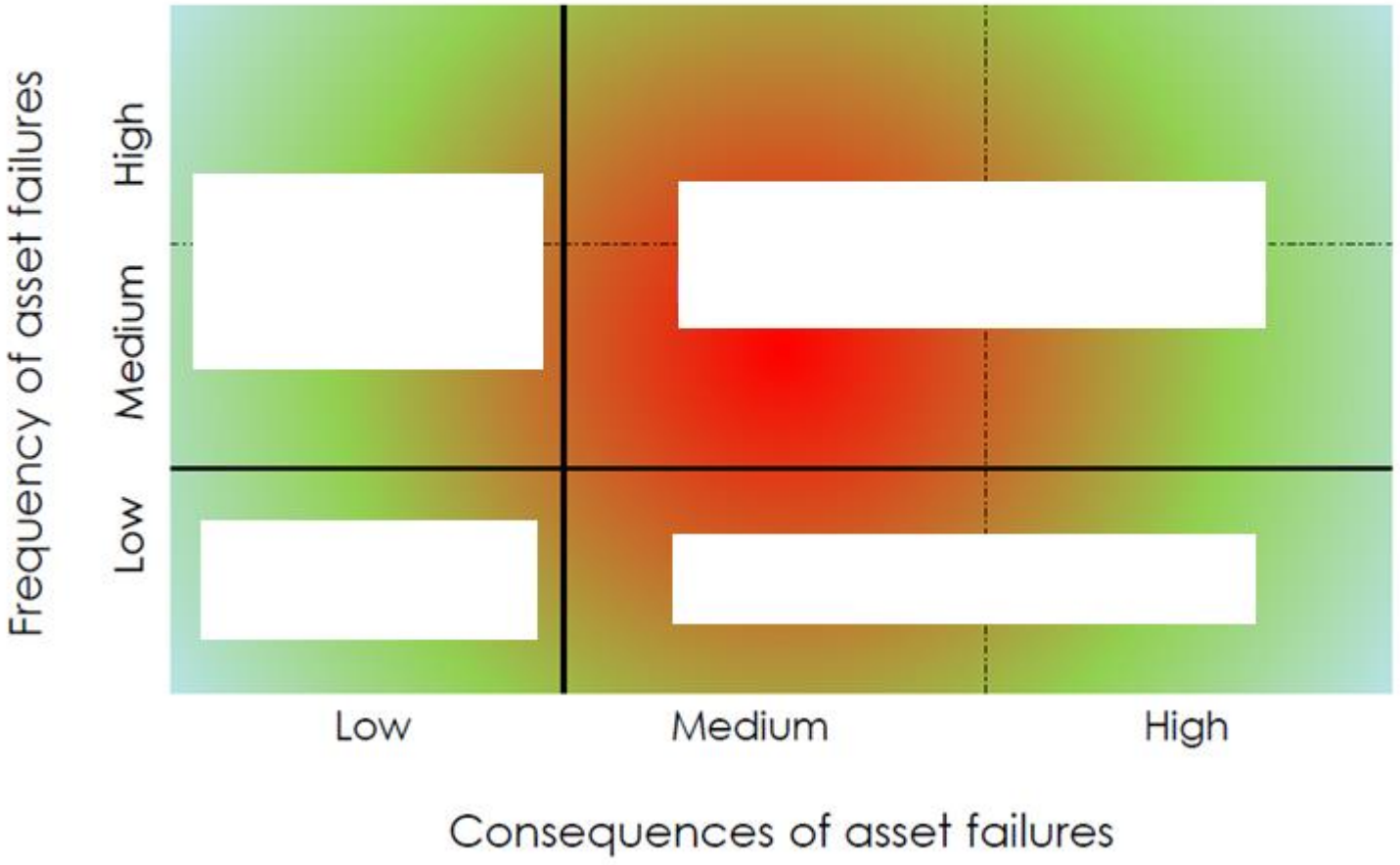
- Closure of RATP Paris line-13 for replacement work

- Shutting of WMATA (Washington Metro) due to cable fire (29 hours-Mar 2015)

Maintenance Philosophy

- Reactive (or Corrective) Maintenance
- Preventive Maintenance
- Condition-based Maintenance (CBM)
- Predictive Maintenance
- Risk-based Maintenance
- Prescriptive Maintenance

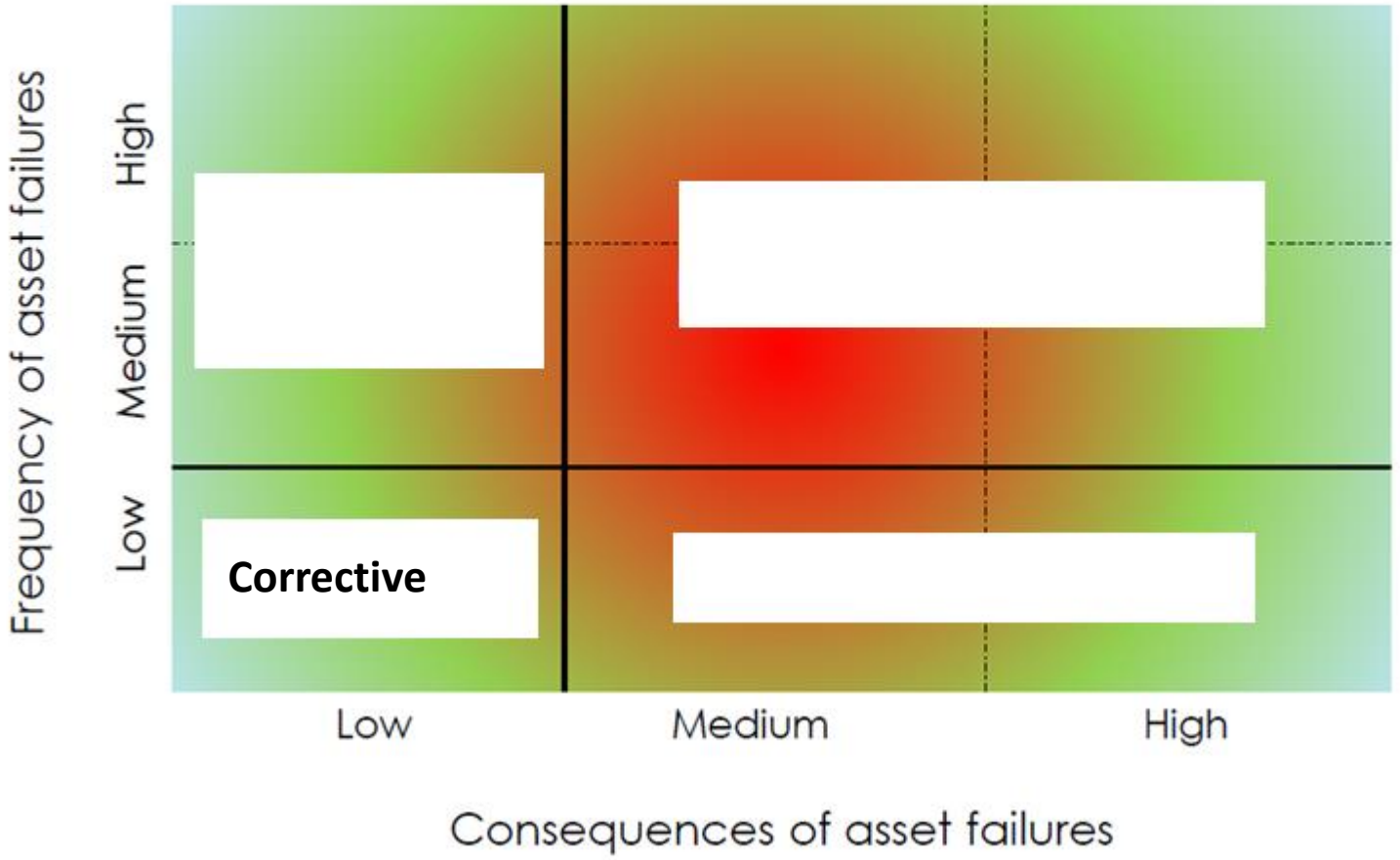
Maintenance type selection strategy



COST-BENEFIT ANALYSIS

Source: Oscar Sbert Lozano& Laurent Dauby, UITP

Maintenance type selection strategy



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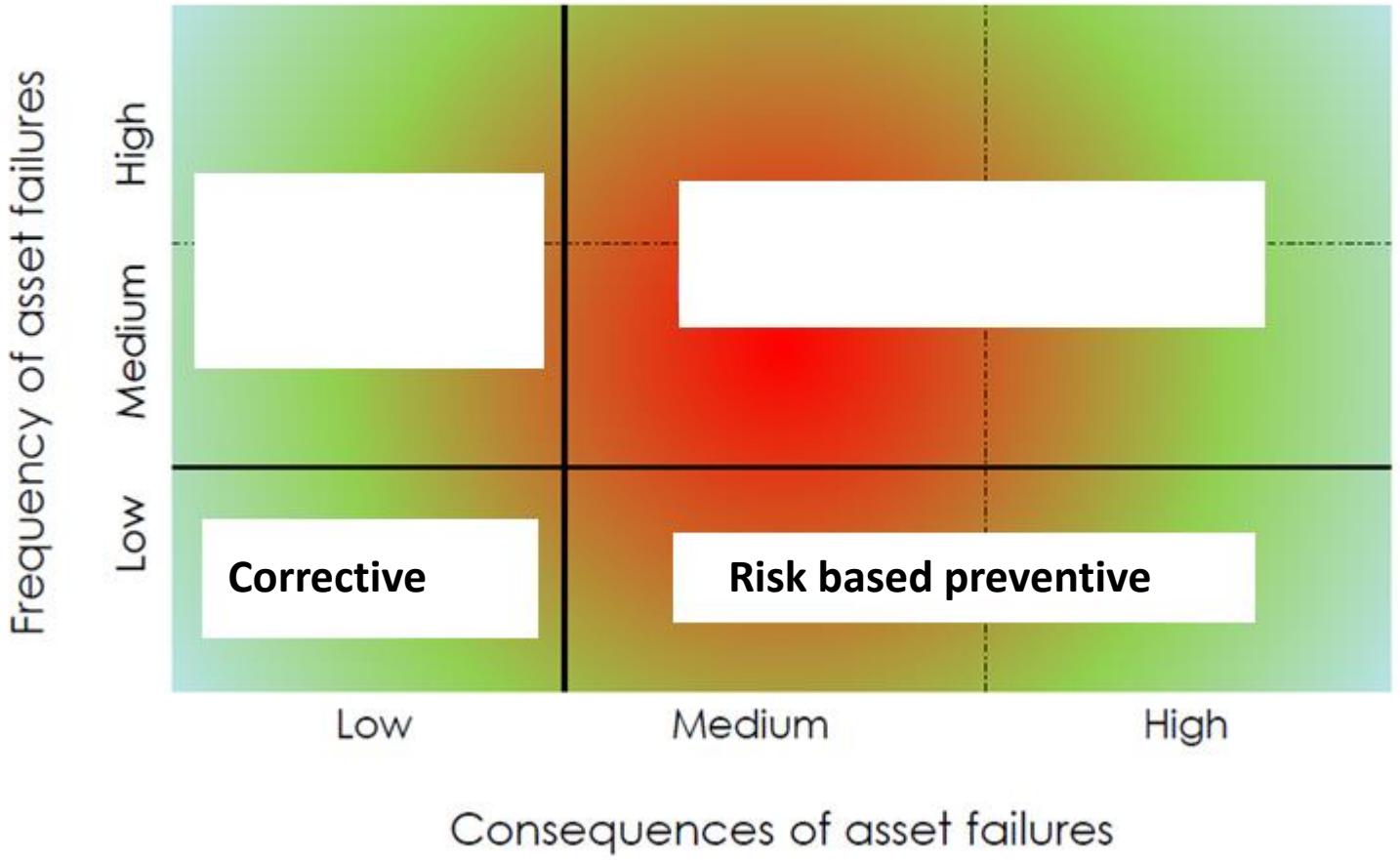

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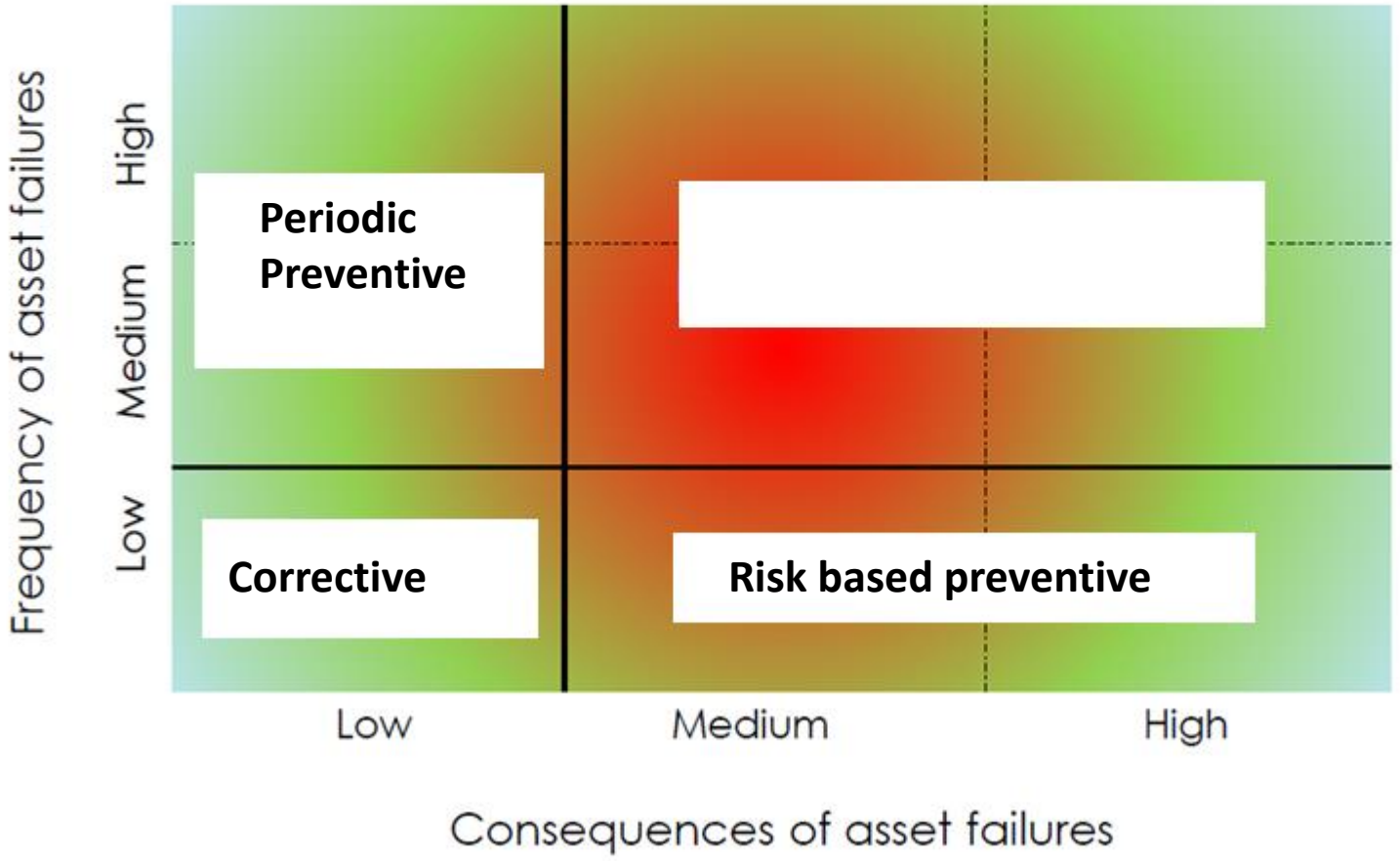

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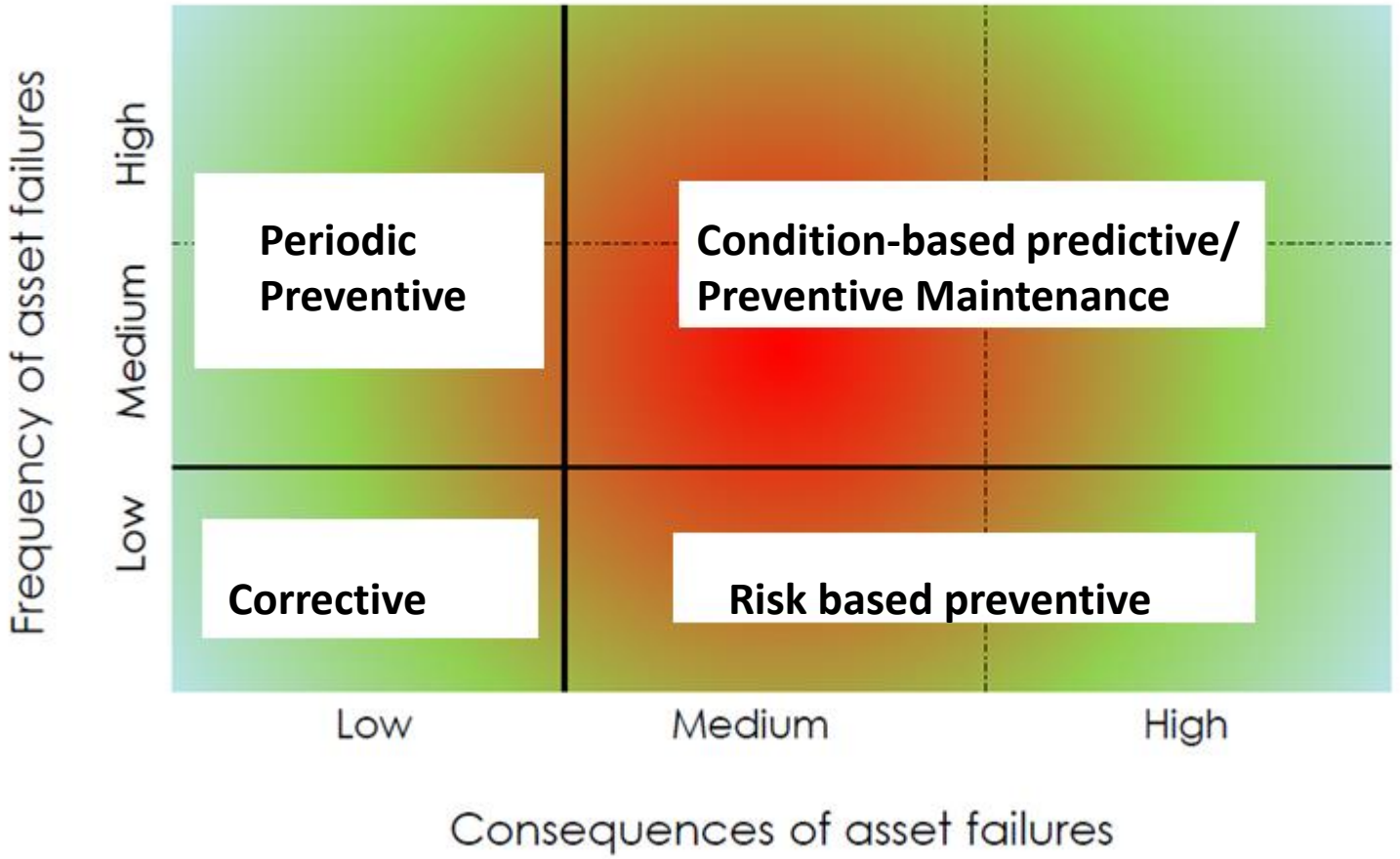

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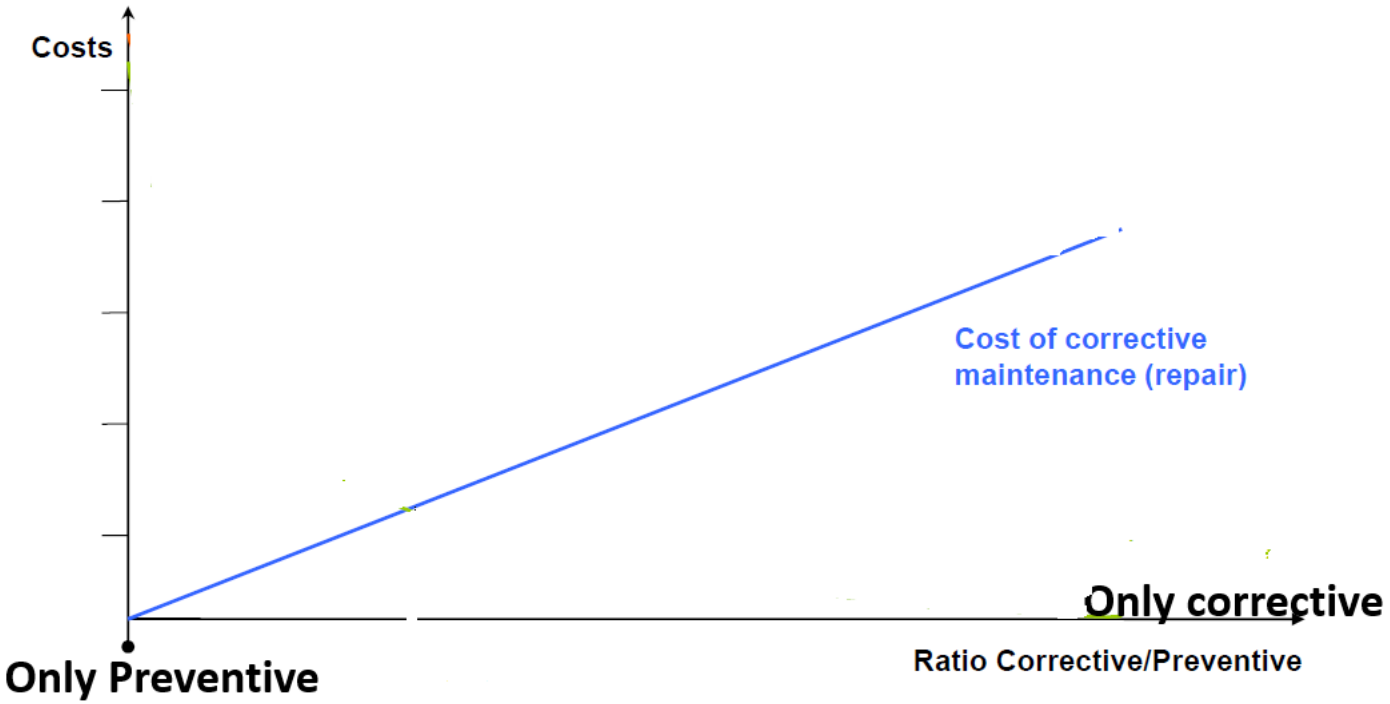
Corrective (reactive)/Preventive (predictive) balance



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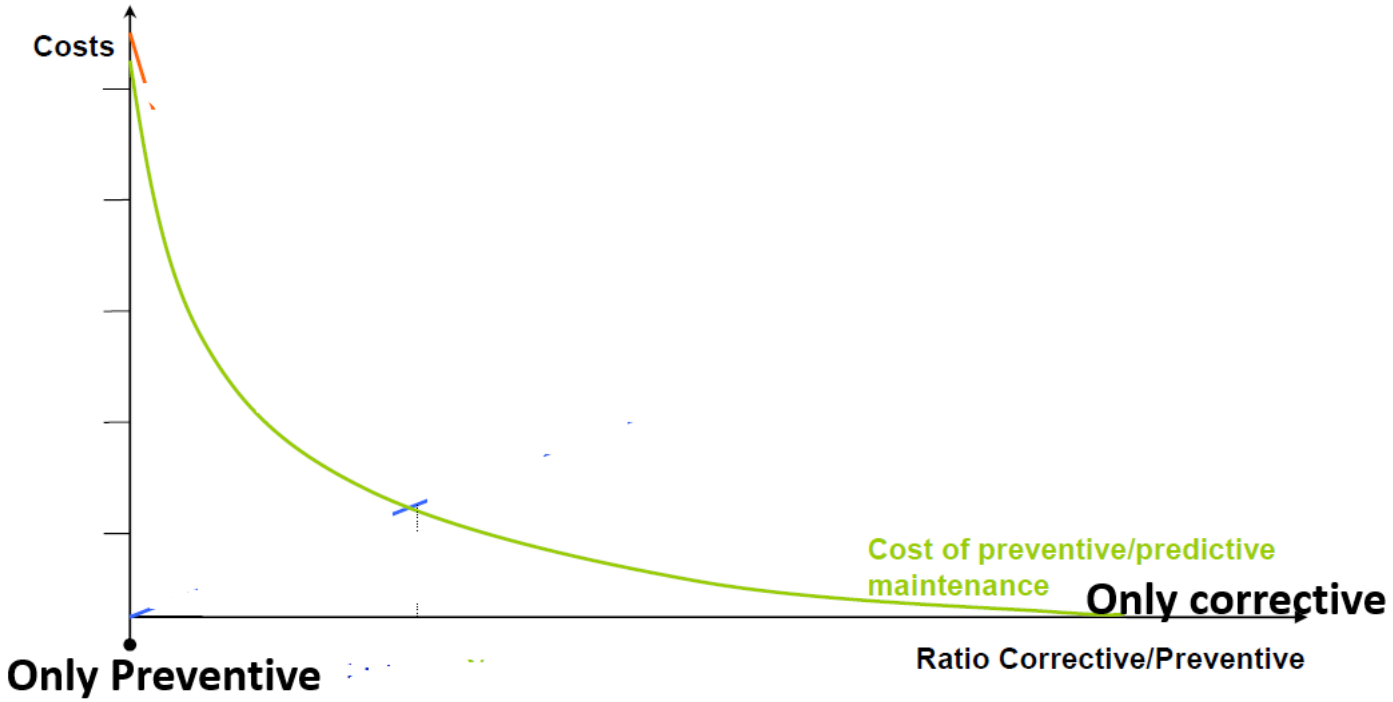

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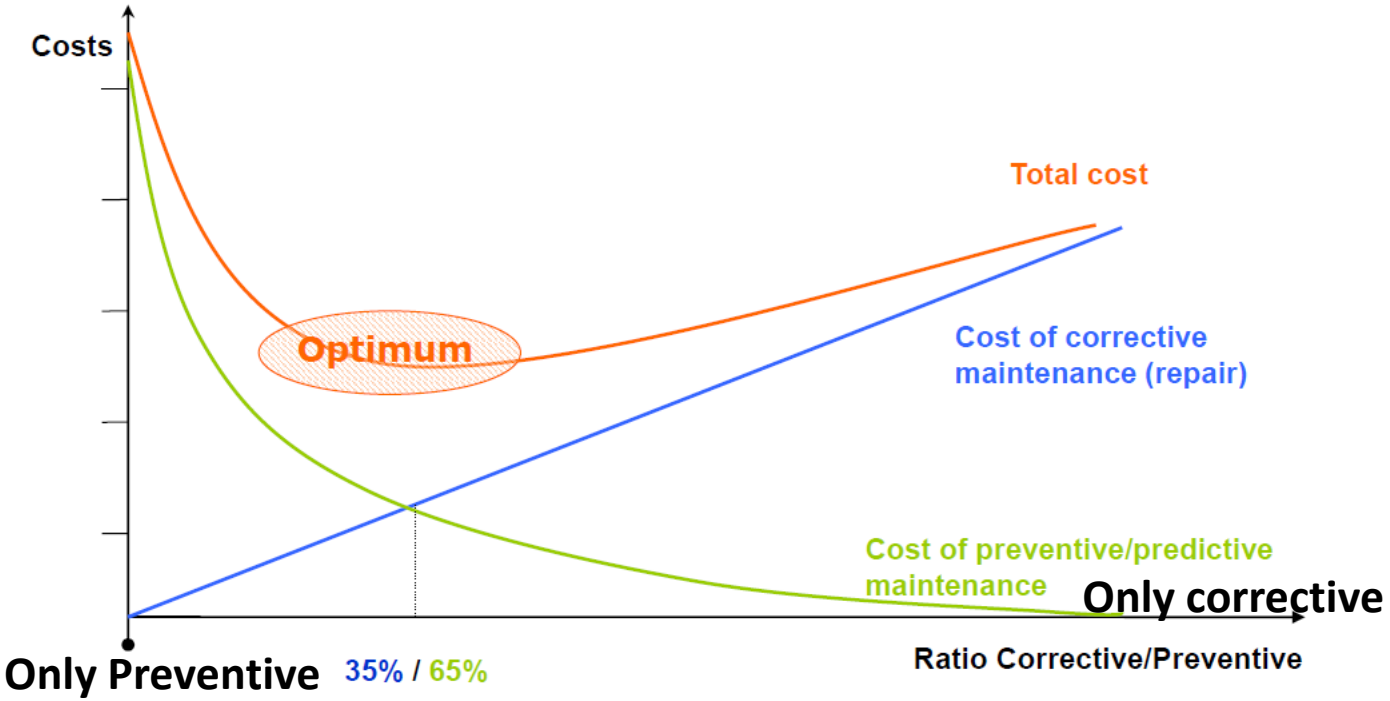

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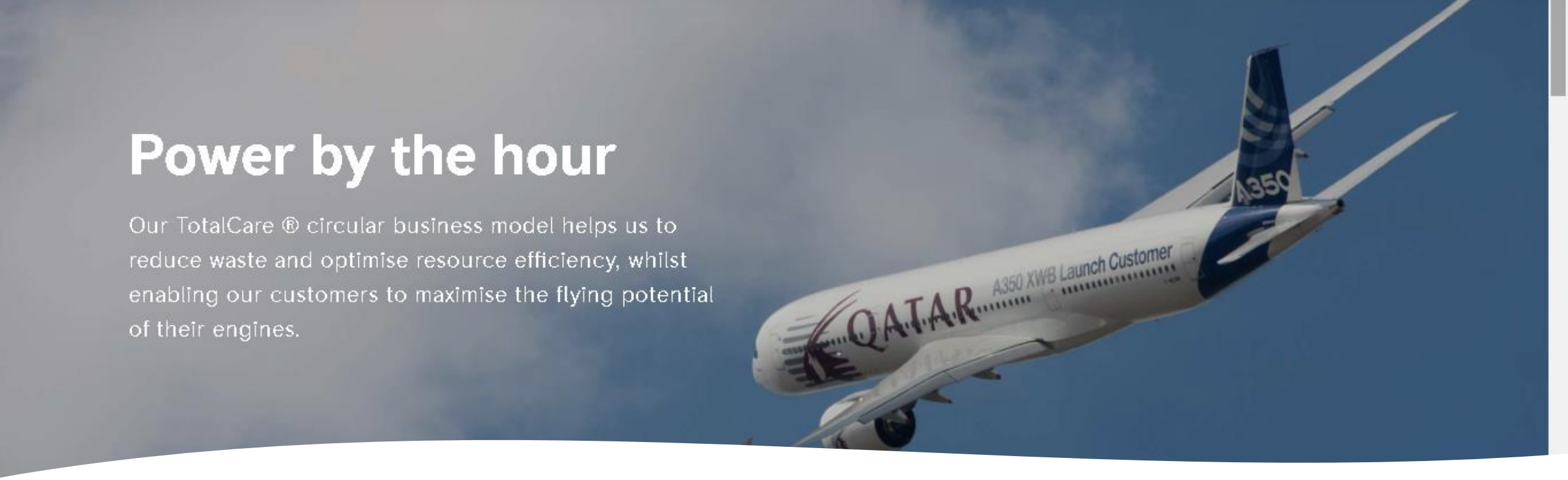
New Business Models- Predictive Maintenance



TotalCare® – Rolls-Royce

- Boeing and Airbus have a business model with Rolls-Royce based on a $/engine flying hour basis.
- Predictive maintenance and repair services that monitor engine health and can modify engine's configuration to increase durability.
- Rolls-Royce takes the entire cost of time-on-wing and shop visits and makes reliability and time-on-wing a profit driver, for both the customer and Rolls-Royce.
- **Example:** How a typical product-based business model has transformed successfully to an outcome-based business model by applying IoT principles.

Train as a Service

Hitachi recently announced a “trains as a service” contract with Virgin in the U.K. for 65 new high-speed Hitachi trains. Under that deal, Hitachi maintains ownership of the trains, and is paid based on their trains’ reliability.

In fact, transportation is the leading edge of HaaS. Bike-sharing programs like NYC’s Citi Bike provide access to bicycles for as little as $15/month. In many cities, car-sharing programs like Zipcar and car2go have replaced the need to own a car. Uber recently launched $5 rates to provide an everyday transportation option for commuters, further reducing car ownership needs.

HaaS can be a shield against the endless march of hardware commoditization.

https://techcrunch.com/2016/07/06/how-hardware-as-a-service-will-save-iot/

Delhi Metro signs its first escalator and lift lease with Johnson Lifts

February 25, 2022 - Updated 07:19 pm IST

Contract involves the procurement of around 179 lifts and 323 escalators

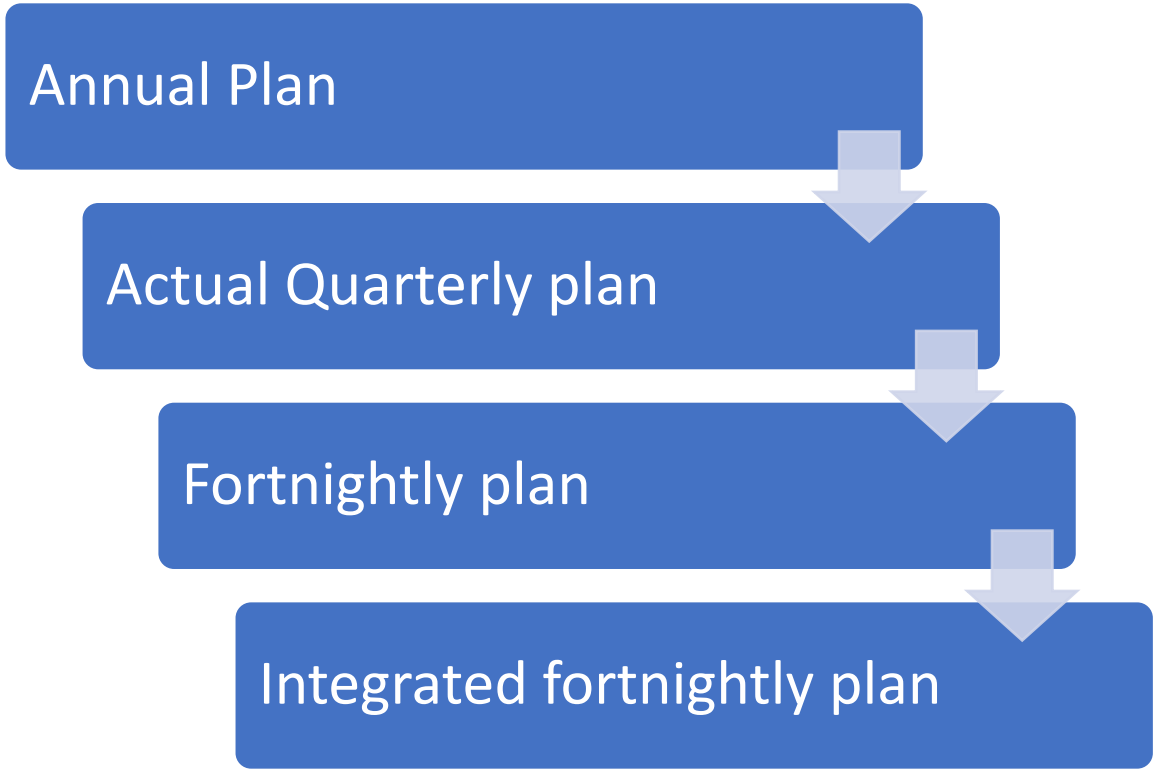
BY BL CHENNAI BUREAU

Maintenance Blocks- Types

- Exclusive Maintenance Block
- General (Integrated) block
- Power Block
- Shadow block
- Train trial
- Emergency block
- Access to viaduct/tunnel during revenue hours
- Other works without impacting train services

How blocks are planned in your metro?

- **Annual requirement** of maintenance blocks based on a mathematical model - actual requirement may be much less.
- **Actual Requirement** –to be worked out on a quarterly basis in advance, section-wise, and separately for each department.
- The work required based on the availability of materials on hand and the presence of adequate workforce in terms of supervisors and staff.
- The quarterly requirement to be translated into a fortnightly maintenance program for each department section-wise.
- The separate fortnightly programs of each department to be interlaced with one another, and an integrated schedule prepared.
- Finally, this integrated schedule will be notified.



AR73 | NSET-BCGN

STATIONS			DSTN	DSFN	DW	DM	NWDA	UNW	UNE	JPW	JPE	TN	SN	TG	RG	RN	MN	KNR	SP	PN	RP	KB	JW	RKA	RCK	BRKR	MDHS	PTMD	IP	YB	AKDM	MVPI	MVPE	NAGR	NSFT	NSST	NSI
1	WED	DAY																																			
		NIGHT							CTMC																			RGM										
2	THU	DAY																																			
		NIGHT								TROLLEY					CTMC							RGM					CMV										
3	FRI	DAY																																			
		NIGHT								TROLLEY										CTMC										TROLLEY							
4	SAT	DAY																																			
		NIGHT	TRAIN TESTING																																		
5	SUN	DAY																																			
		NIGHT	TRAIN TESTING																																		
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		NIGHT													CTMC													CMV									
10	FRI	DAY																																			
		NIGHT						TROLLEY TRANSFER FROM NJFD TO YBD THAT'S WHY CMV IS CURTAILED																													RGM		
11	SAT	DAY																																			
		NIGHT	TRAIN TESTING																																		
12	SUN	DAY																																			
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15	WED	DAY																																			
		NIGHT	RGM						CTMC																TROLLEY												
16	THU	DAY																																			
		NIGHT					RGM								CTMC													CMV									

Optimizing Block Time

- **Ineffective period**

- Used in the preparation, reaching the site, clearing the site after completion of work, reaching the nearest station to cancel the block, discharging, and charging the OHE.

- In a normal block, staff works only for four to five hours only which includes pre-block and post-block activities.
- **Longer Blocks -** One seven-hour block is equivalent to two blocks of four hours each as illustrated below:
  - The ineffective period in a block for preparation = 1 hour
  - The effective period in a 4-hour block = 3 hours
  - The effective period in a 7-hour block = 6 hours
  - In a seven-hour block, only one shift of maintenance staff is required, thereby saving maintenance staff.

- Plan late starting of trains (Say 800 hrs) on Saturdays and Sundays and plan longer blocks (0000-0800)

Optimizing Block Time

- Two long blocks on weekend are equivalent to four weekdays blocks
- There may not be any need for daily blocks during the night.
- Improve the well-being of the maintenance staff
- Staff can maintain other assets in the daytime.
- For example, the track maintainers should be able to maintain buildings during the daytime, or OHE staff may deal with Electrical and Mechanical (E&M), lifts/escalators, etc.

Pilot Train

- After the cancellation of all the blocks, the first train in all sections performs piloting at a specified speed (40 kmph in DMRC).
- To ensure that the section is fit and clear of any obstruction from the machine or tools used during the maintenance work.
- No such system in main-line railways
- If necessary, the first passenger train to be run at a specified reduced speed with caution to look out instead of running an additional empty train as a pilot train.

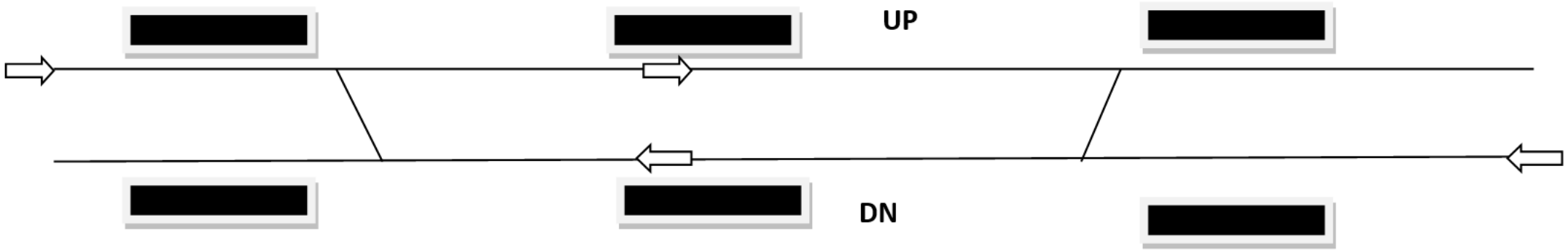
Outstation stabling

- Block time duration can be enhanced by stabling few trains at the stations during the night
- The first train in the morning can be inducted from the station thus saving some time for induction of the train from the maintenance depot.
- Required planning of sidings
- Wake up equipment required for DTO/UTO
- Crew to be made available at the time of introduction of trains
- **How many trains can be stabled outside the depot?**
- 1/3-2/3 trains can be stabled outside depending upon
  - Availability of stabling space
  - Maintenance frequency
  - Washing frequency

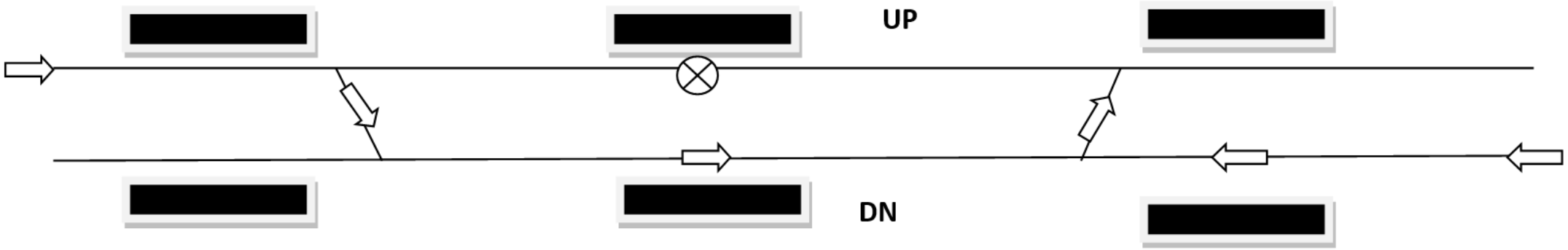
Single Line Working For Longer Blocks

- In the early morning and late hours a longer headway (say 15 minutes) may meet the demand.
- Signalled **bidirectional** movement available in Metro systems.
- Mega blocks may be plannred on a section of one line while using other line for both direction movement.
- Availability of block hours from 4-5 hours to 6-7 hours without impacting train availability sigbificantly
- Change in the platform required for one direction of the trains as both direction trains will be dealt with through a single platform.

NORMAL OPERATIONS

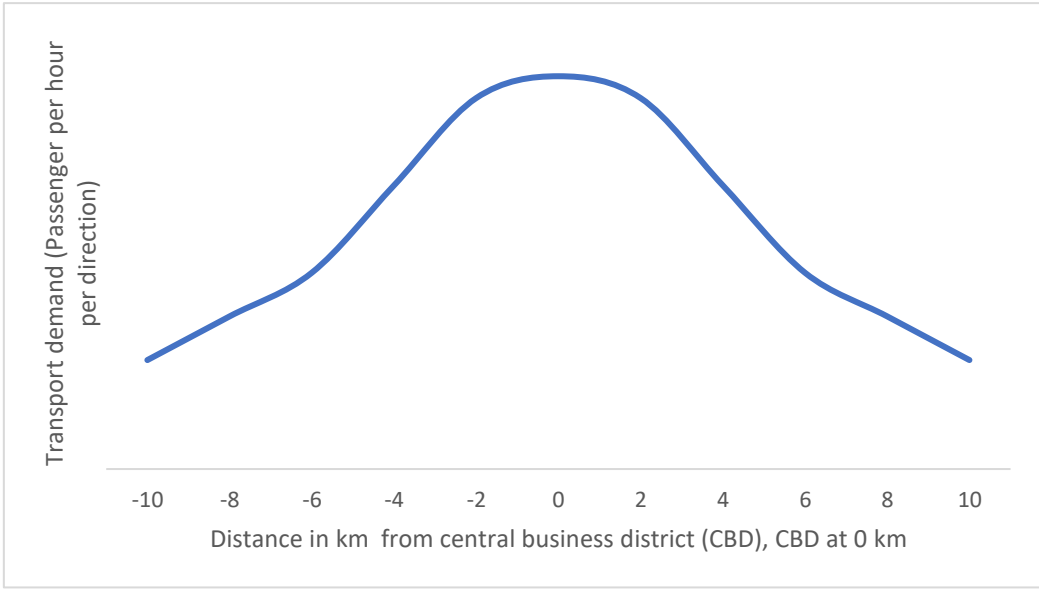


SINGLE LINE OPERATIONS FOR MAINTENANCE ON UP LINE

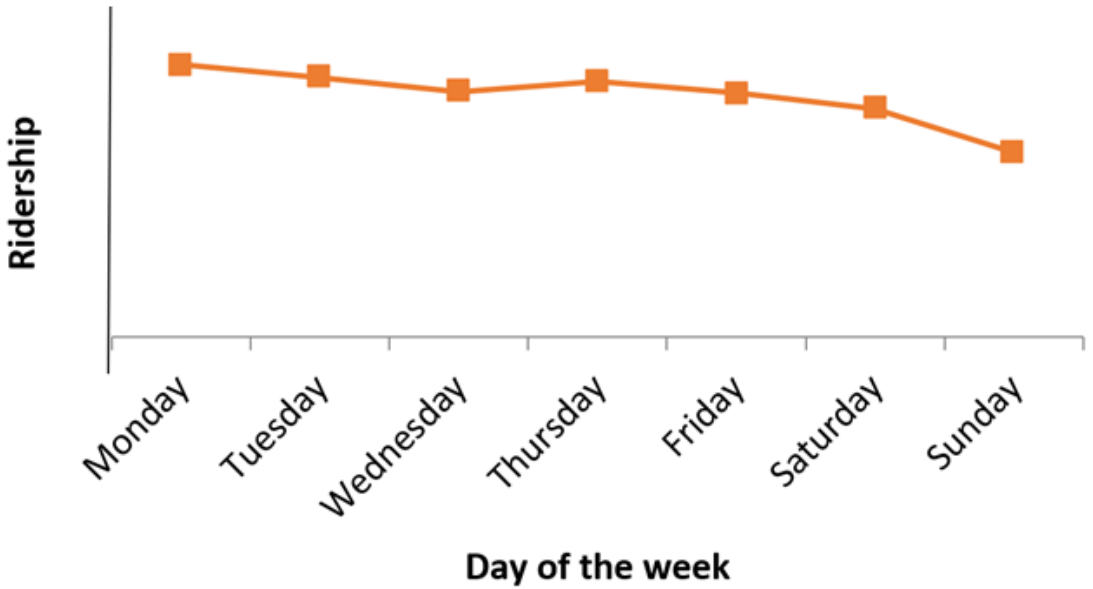


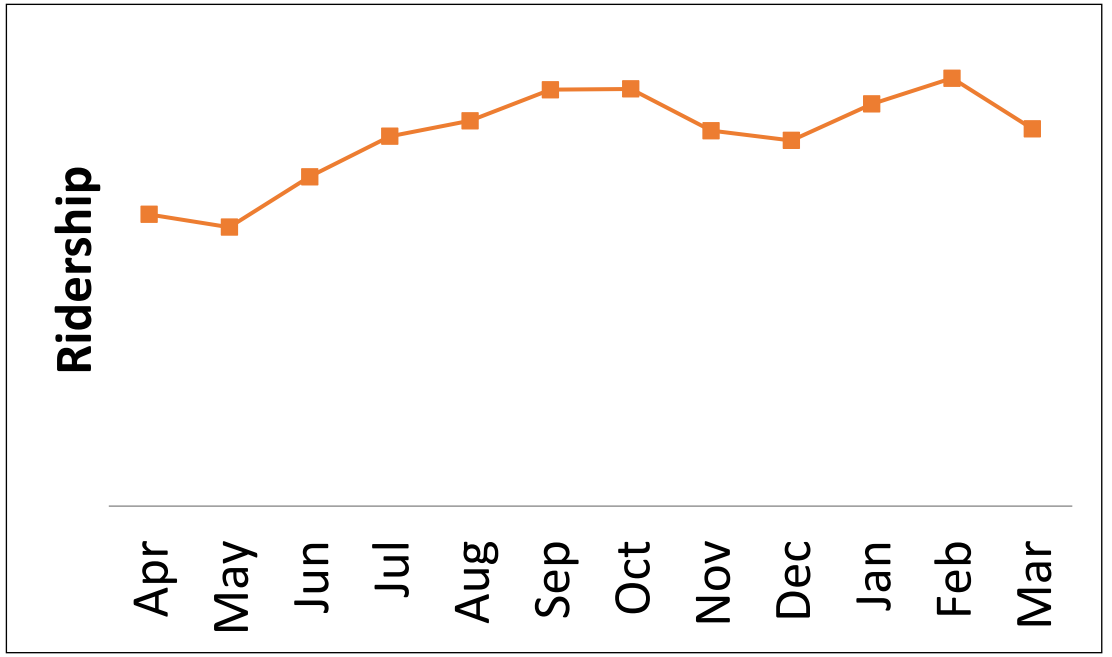
Spatial Distribution of Demand

- Longer blocks at the end of the lines.
- May be clubbed with Single line working if depot is at the one end.



Weekly and monthly variation of demand





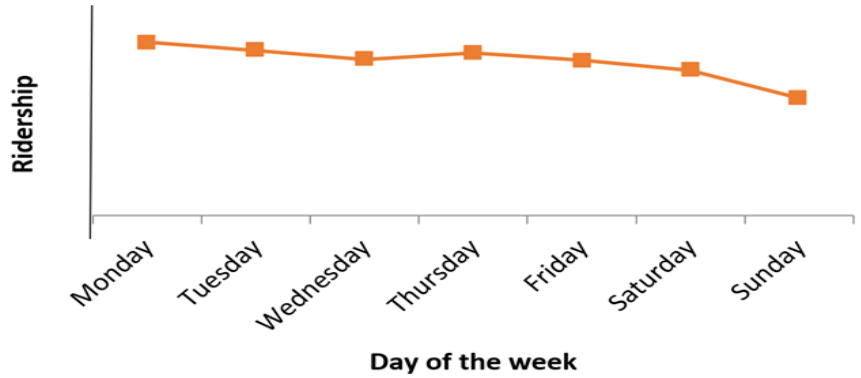
Maintenance optimisation through timetabling

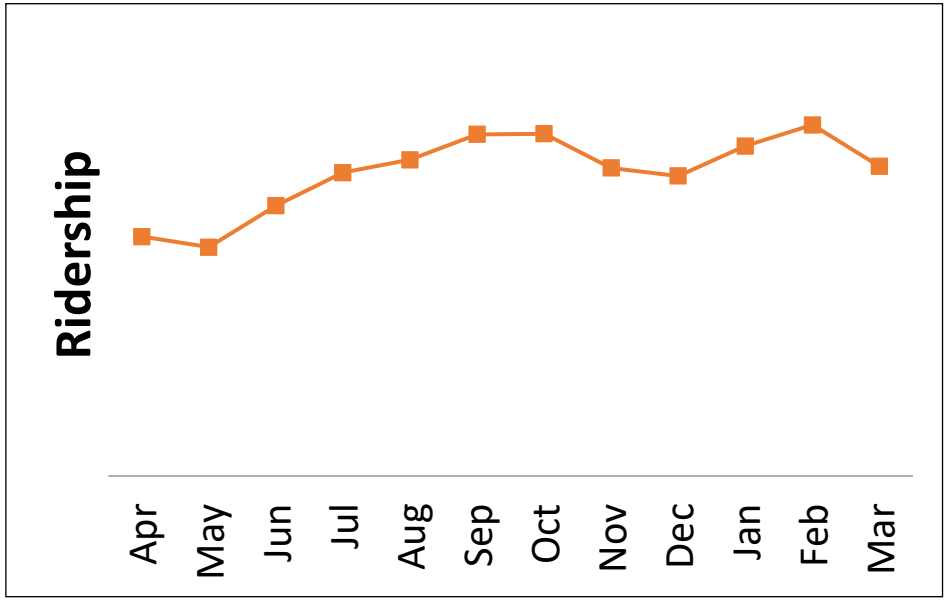
a) Demand is higher in the first half of the week (Mon, Tue), the maximum number of high-capacity trains (6C trains) maybe put in service in the first half of the week.

b) The demand rises from May to September and then drops till December, again rises from January to February, and then drops in March and April. The maintenance could be so scheduled that the maximum number of trains are available in the months of January, February, and from May to September. The non-critical maintenance activities may be deferred to the remaining months of the year.

c) The train services may be reduced in the holiday months, say October to December and a greater number of rakes taken for maintenance.

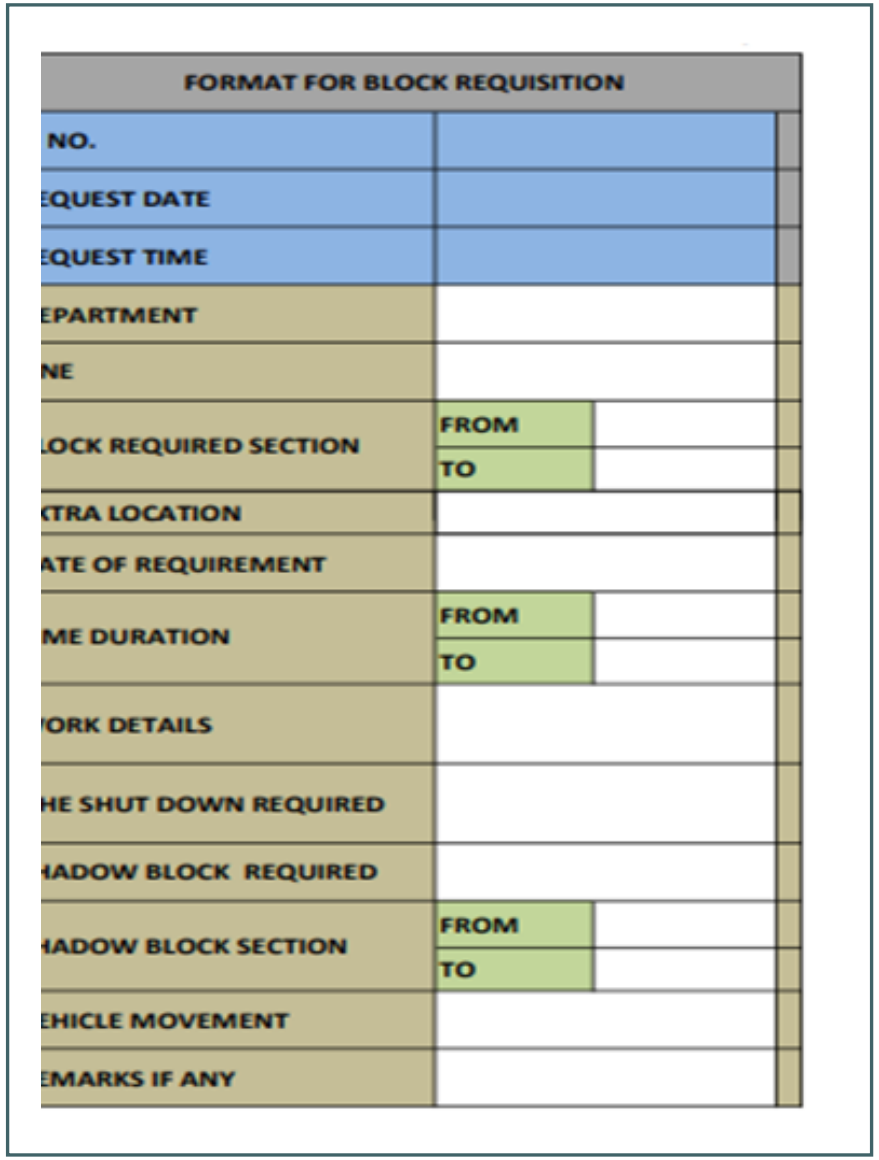
d) With the withdrawal of trains during non-peak hours, some of the rakes may be maintained during the daytime.





MAINTENANCE BLOCK MANAGEMENT PROCESS

- The request for the various blocks in the ensuing week, commencing from Monday to Sunday, should be submitted to the OCC by Friday by all the concerned departments
- After scrutinizing the various requests for all lines, EP/IB/power block/shadow power block should be prepared and issued by the OCC in the form of weekly general order, for the ensuing week.
- Section of the exclusive maintenance block (engineer's possession) may be categorized as a “restricted zone” and a section of the general block (integrated block) may be categorized as “green zone” in the weekly general order.



FORMAT FOR BLOCK REQUISITION		
NO.		
EQUEST DATE		
EQUEST TIME		
EPARTMENT		
NE		
LOCK REQUIRED SECTION	FROM	
	TO	
XTRA LOCATION		
ATE OF REQUIREMENT		
ME DURATION	FROM	
	TO	
ORK DETAILS		
HE SHUT DOWN REQUIRED		
HADOW BLOCK REQUIRED		
HADOW BLOCK SECTION	FROM	
	TO	
EHICLE MOVEMENT		
EMARKS IF ANY		

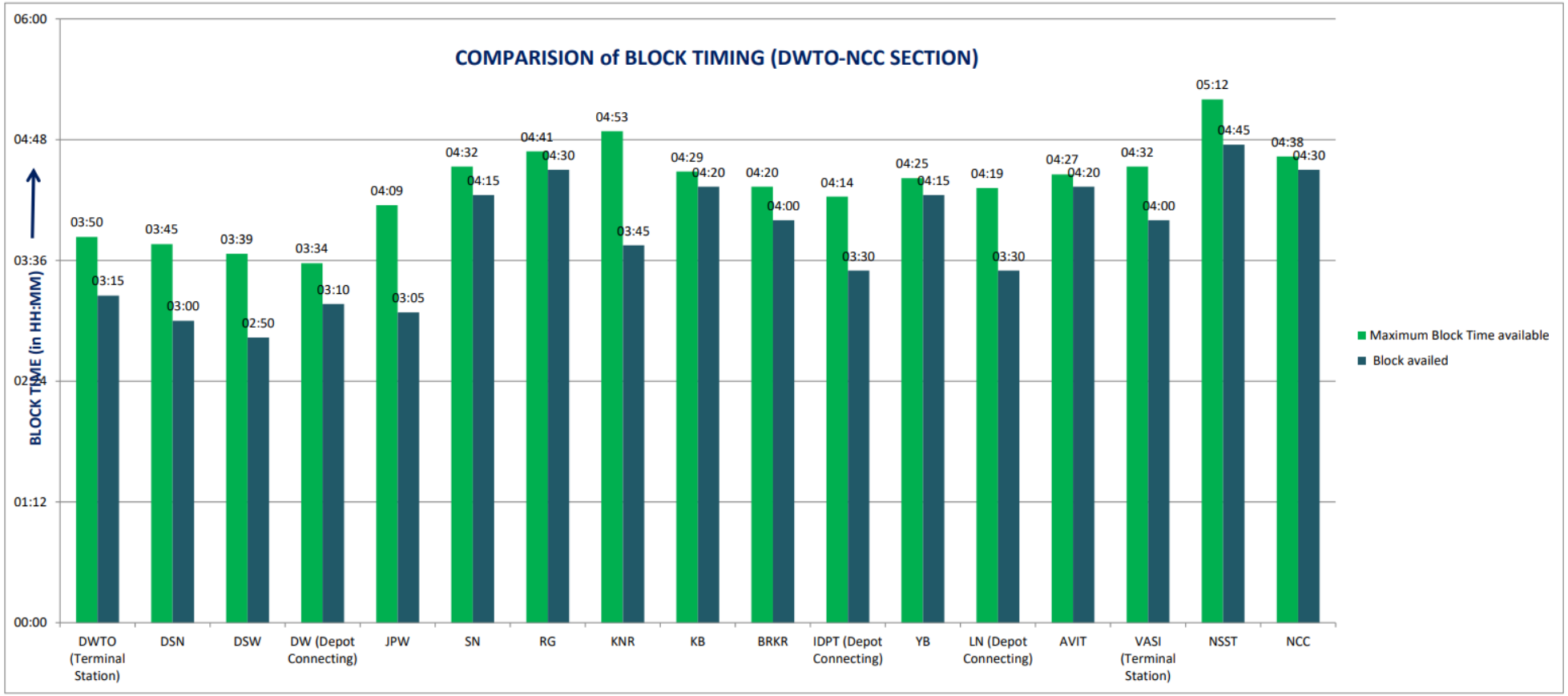
GENERAL BLOCK ORDER FOR LINE-XXXX FOR xxx DAY DT. X.XX.XXXX										
S. NO	BLOCK TO	SECTION BETWEEN	NATURE OF WORK	TRACTION POWER SHUT DOWN REQUIRED	TIME		ENTRY /EXIT POINT	No. Of Trains/ Veh	EPIC	Remarks
					FROM	TO				
RESTRICTED ZONE (EP SECTION)										
1	XXX Deptt.	X PF - Y PF	XXX vehicle movement for XXX work	YES	xxx hrs.	YYY hrs.	XX Station / YY station	1 XXX vehicle	JE/XX Deptt	Ensure all safety measures. EP zone to be secured by TC by applying maintenance block/signal block through ATS and by EPIC by placing red banner at both ends for protection of EP/IB section
GREEN ZONE (IB SECTION)										
4	XXX Deptt.	AA PF - BB PF & XX PF - ZZ PF	XXX Maintenance work	YES	xxx hrs.	YYY hrs.	AA PF - BB PF & XX PF - ZZ PF	NIL	JE/XX Deptt	Ensure shadow power block if req.
			Foot Patrolling	YES	xxx hrs.	YYY hrs.			JE/XX Deptt	Ensure shadow power block if req.
5	XXX Deptt.		Maintenance of sig. & points etc.	YES	xxx hrs.	YYY hrs.			JE/XX Deptt	Ensure Shadow Power Block if required.
6	XXX Deptt.		Patrolling,Maintenance & Inspection of track; Greasing of curves; Cleaning of Viaduct .Packing of ballasted track,Rail panel welding work	YES	xxx hrs.	YYY hrs.			JE/XX Deptt	Ensure shadow power block if req.

1	All EPIC's will liasion with OCC and station controller of concerned station to ensure safety.	LIVE OHE SECTION:
2	All departments to take care of trolley/CMV movements especially in case of complete shutdown of ASCV.	1. To avail block in OHE live section EPIC will give in writing that work does not require OHE in 'DISCHARGED' condition & he has the competency to carry out the intended work in 'OHE CHARGED CONDITION'. 2. All SC must ensure that Pvt no for PTW of technical department (i.e. S&T, OHE, etc.)from OCC to be exchanged first on priority. 3. All departments of O&M can work in the General/Intregated block section without affecting track and other structure integrity.. 4. TC to ensure CTMC/CMV induction at main line following last train so that CMV can work for entire block period effectively. 5. PTW in general block section to be granted only after night testing train/maintenance vehicle have cleared the respective IXL.
3	Safety during the block is responsibility of supervisors getting the block.	
4	All trollies have to verified by their supervisors stating that no grease or oily material is coming out from their trollies.	
5	All EPIC's to coordinate with each other during the block.	
6	Block may be permitted after passage of last train to departments desires to work in live OHE, with suitable endorsement in PTW.	

Scrutinized by:	TPC	SIG.C	RSC	ASC	OCM/(OCC INCHARGE)

Monitoring of output of blocks

- Block demanded
- Block offered
- Block availed
- Block output



BLOCK MANAGEMENT APPLICATION (BMA)

- The process of block management may be computerised for optimising block utilisation, checking of various safety parameters, and ensuring that conflicting blocks are not granted.
- BMA should be made available on the computer and as a mobile application.
- The metro operator should make sure the BMA covers various stages of block management, includingblock requisition, compilation, approval, modification, permit to work granting/cancellation and report generation.

Modules of BMA

- The maintenance user module is to place demand and availing blocks by the maintenance and operations department.
- OCC module is for consolidating the block demands, issuing block orders, and monitoring the blocks.
- Station module is for the station staff to grant or cancel the permit to work and allow entry/exit to the maintenance staff at the station.
- Management module is for overall monitoring of the blocks and progress of work by the management. There should be a dashboard for the metro operator to monitor the progress of works and generate positions like blocks requested/granted/availed/cancelled by a department over a given period.

Best Practices- Asset Maintenance

- A comprehensive policy must be formulated for mechanized maintenance of the track, OHE, and signaling systems covering all aspects.
- A computerized database must be maintained for keeping an accurate record of all aspects of maintenance blocks.
- Each department must decide and circulate a list of maintenance works section-wise that can be carried out only under traffic blocks.
- Optimal mix of corrective, preventive and predictive maintenance
- Maintenance schedules should be laid down for all assets, along with a detailed checklist of features to be checked during each type of schedule.
- All blocks except in the case of emergencies must be programmed, pre-planned and pre-notified.
- Block must be granted to the extent of hundred percent of the actual requirement.

Best Practices

- Each maintenance block granted must be simultaneously used by all departments so that the overall requirement of the blocks remains minimal and integrated.
- Actual output during the block must match the stipulated output. Any shortfall should be analysed.
- There must not be any incident of block bursting and in case of any such occurrence, same must be analysed to see whether it was avoidable, and if necessary, responsibility fixed at an appropriate level.
- During integrated maintenance block, maintenance works required to be undertaken by all departments such as, civil, electrical (OHE) and signal
- Whenever the TC grants the block in a particular section simultaneously maintenance block/ signal block should also be applied through the train control system (ATS/LATS/VDU) in the same section to avoid any conflicting movement of ATP and non-ATP vehicles.

Best Practices

- The sectional jurisdiction of supervisors of the different departments such as track, signalling, traction should be same for implementing the above concept of integrated blocks.
- There are certain activities of maintenance that require coordinated efforts of all three departments namely, civil, signal, and electrical, or sometimes even between two branches of the same department. These include maintenance of points and crossings, emergency crossovers, shifting of the track, etc. Maintenance of these assets must be undertaken by all departments simultaneously so that there is no mismatch.
- Integrated maintenance vehicles must be explored and procured so that the staff and materials of all departments can move together.
- The percentage of block availed periodically must be monitored.
- Mega blocks on weekends
- Outstation Stabling of trains

Thank you

Rusty Rail Movement

- The line segments, crossovers, point zones & sidings over which the train movements during normal course are very rare or practically non-existent, are likely to become rusty and thereby cause the AFTCs equipped thereon to behave erratically when any rare movement over them is contemplated.
- Such line segments, crossovers, point zones & sidings shall be carefully identified by S&T Wing on which rusty movement during non-revenue hours is required to be carried out and communicated to concern OCC so that it can be included in the time table of the line.
- It has to be ensured that at least once in a day or alternate day rusty movement is carried out over such lines/crossovers/points zone for proper functioning of AFTC's.