CONFERENCE OMAINTEC 2018 EXHIBITION

INTERNATIONAL OPERATIONS & MAINTENANCE CONFERENCE
IN THE ARAB COUNTRIES

UNDER THE THEME
"MANAGING MAINTENANCE WITHIN INDUSTRY 4.0"
CONICIDE WITH THE 16TH ARAB MAINTENANCE EXHIBITION

DEVELOPMENT OF PMS FOR ROAD AND AIRPORT NETWORKS

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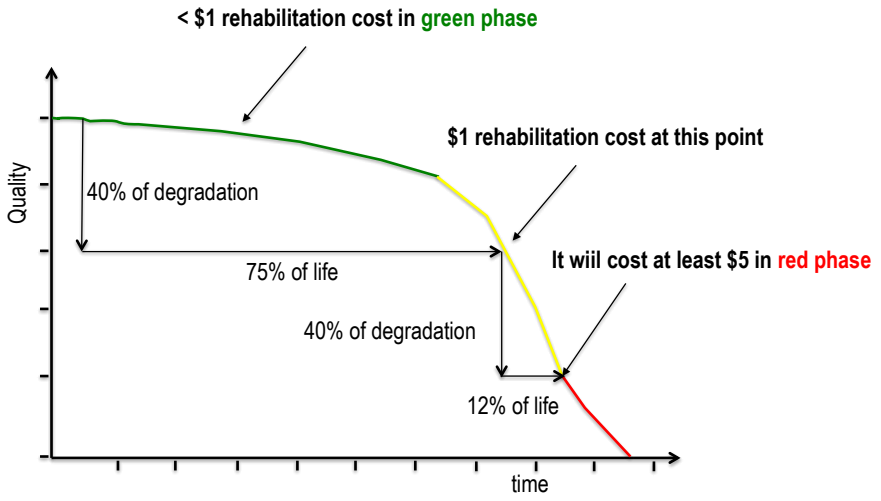
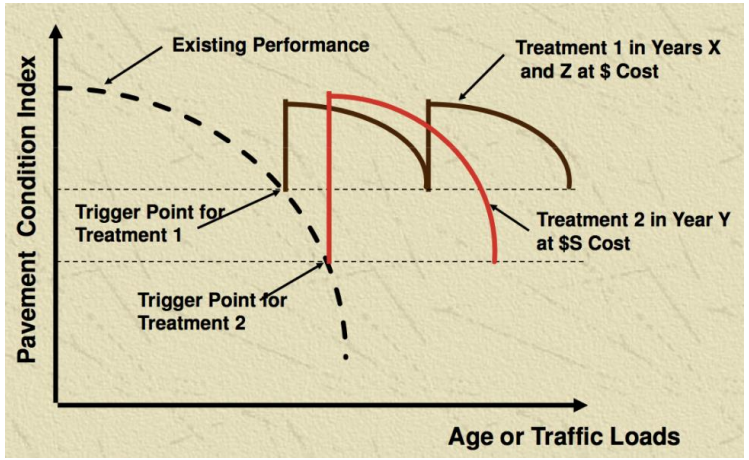
OUTLINE

- **Overview/Motivation**
- **General approach**
- **Pavement condition survey**
- **Aid-decision framework**
- **Final remarks**

OVERVIEW / MOTIVATION

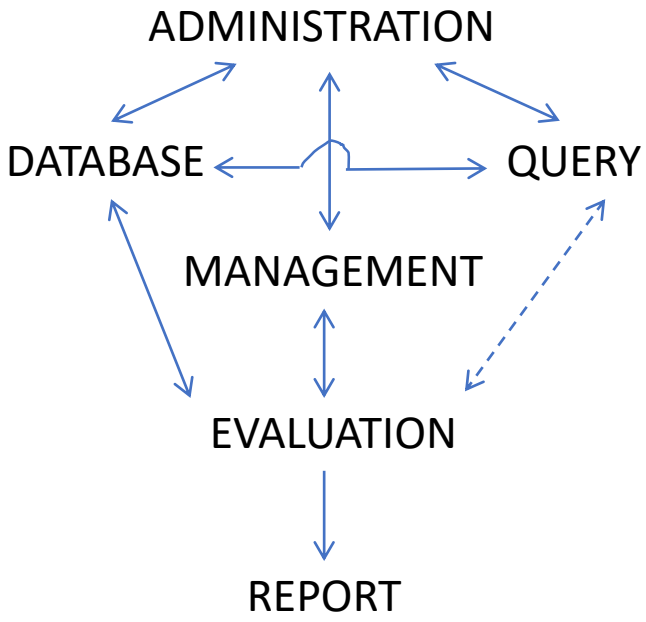
- Saving costs to deliver the service
- Prevent and not repair
- Support the decision through an expert, friendly and trustable system
- PMS analyzes the network from its current state and with an objective for a certain period (3, 5, 10 or more years), indicates which maintenance action on the right date should be done on a network section in order to be cost-effective in support the service to deliver to the users
- This is done using behavior models, probabilistic or deterministic, to predict the pavement state and using a decision-aid tool, indicate the better strategy considering the applicable restrictions





GENERAL APPROACH

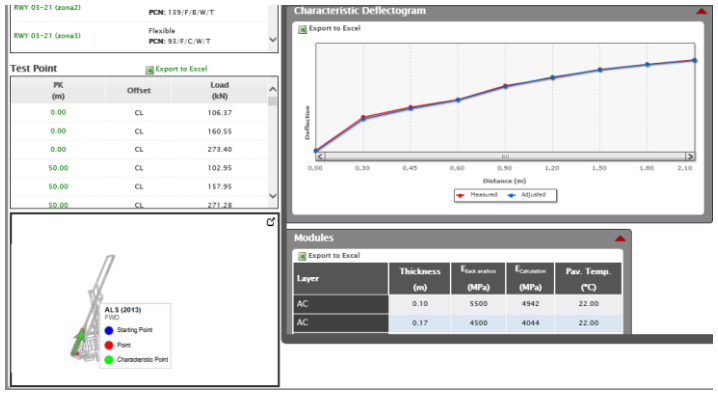
- General structure (MODULES)

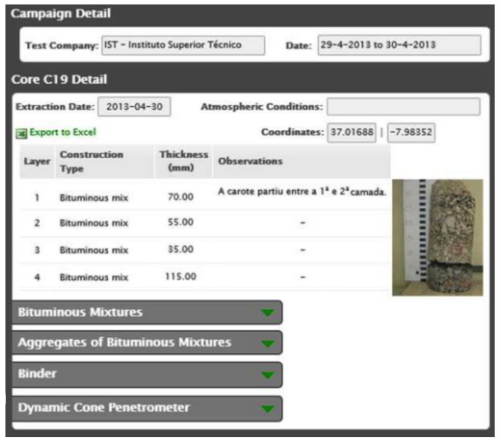


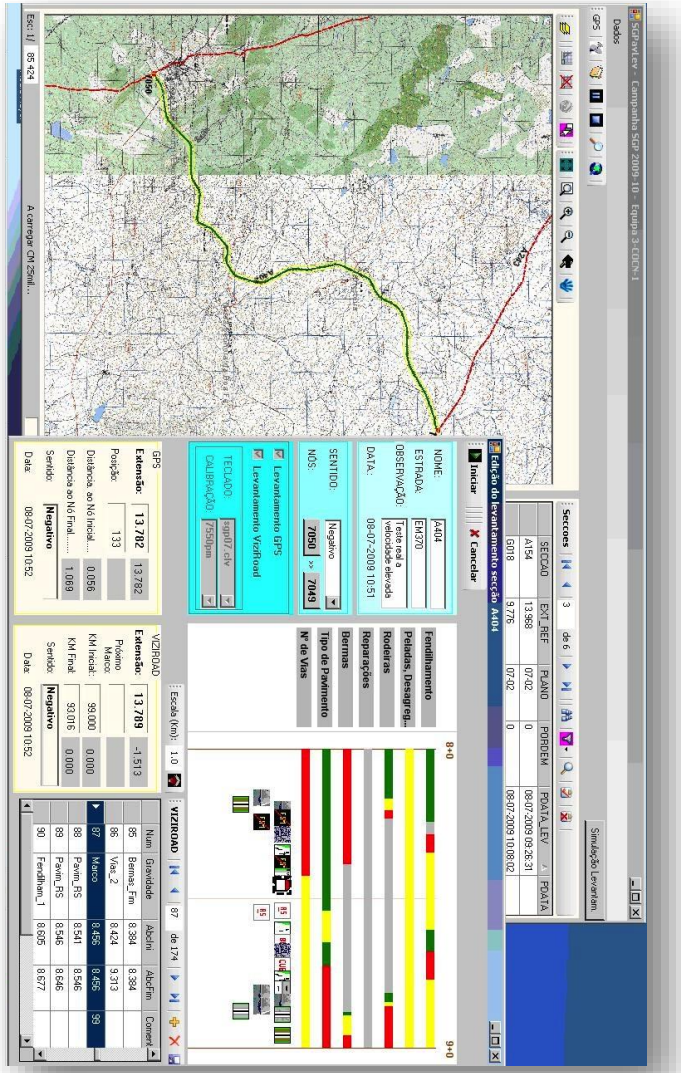
- Web-based system, developed over a geographical information system (GIS), in order to allow remote access to all information for the pavement maintenance groups in the different positions/assets of administration and to allow the representation and use of all kind od data.

PAVEMENT CONDITION SURVEY

- Obtain the necessary knowledge concerning the pavements behavior and its condition evolving.
- Construction and rehabilitation parameters
- **Field surveys**
  - Surface (visual) survey
  - FWD
  - IRI
  - Strait Edge
  - Texture
  - Skid resistance
  - Pavement cores

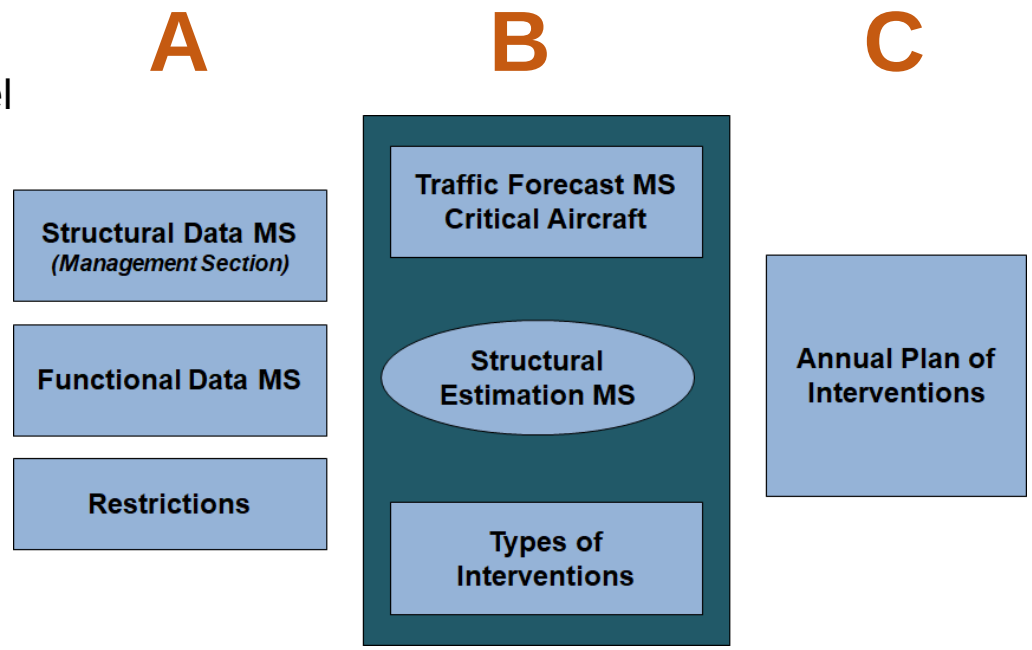






AID-DECISION FRAMEWORK

- **Degradation model to evaluate pavement life-cycle**
  - Neuronal network tuned for each asset based on a deterministic behavior model
- **Evaluate different scenarios**
  - Different planning periods (3, 5, 10,…)
  - Different Grow Rates for traffic
  - Different Traffic Distribution
  - Different Quality Levels
  - Different type of solutions for preventive maintenance
- **Predict intervention costs**
- **Automatic reports**

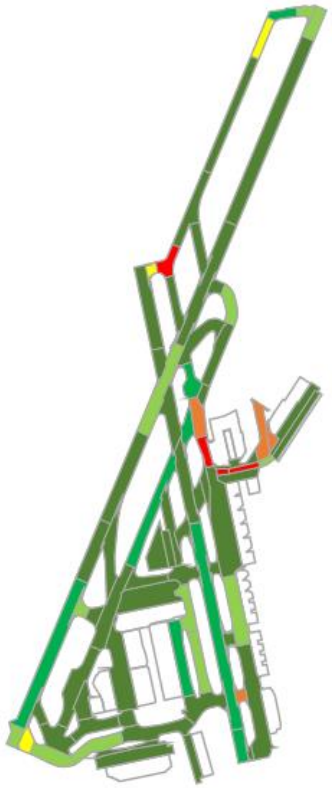


AID-DECISION FRAMEWORK

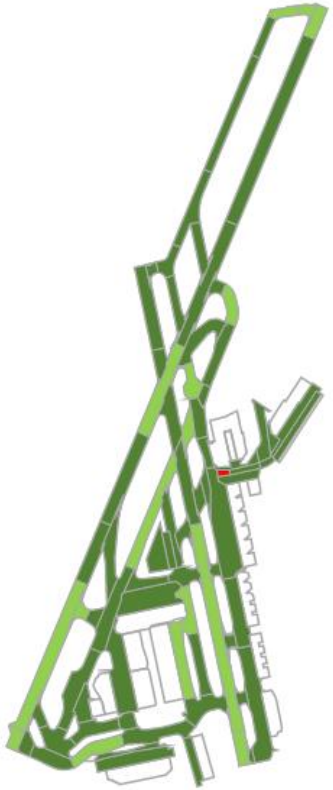
Constraint	Type of Constraint	Unit
Planning Period	-	Year
Intended Quality Objective for the section at the end of the analysis period	Quality	Year
Intended Quality Objective for the section in each year of the analysis period	Quality	Year
Penalty to restore the intended residual life in terms of cost in each section	Monetary	%
Minimum residual life (for activation of intervention priority)	Quality	Year
Update rate	Monetary	%
Minimum residual life at the end of the analysis period	Quality	Year
Maximum number of intervention days in a given year	Operational	-
Maximum number of sections with interventions in the same year	Operational	Day

AID-DECISION FRAMEWORK

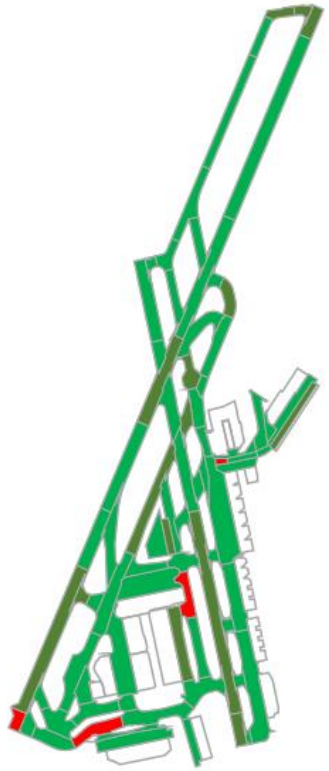
Year 0



Year 3



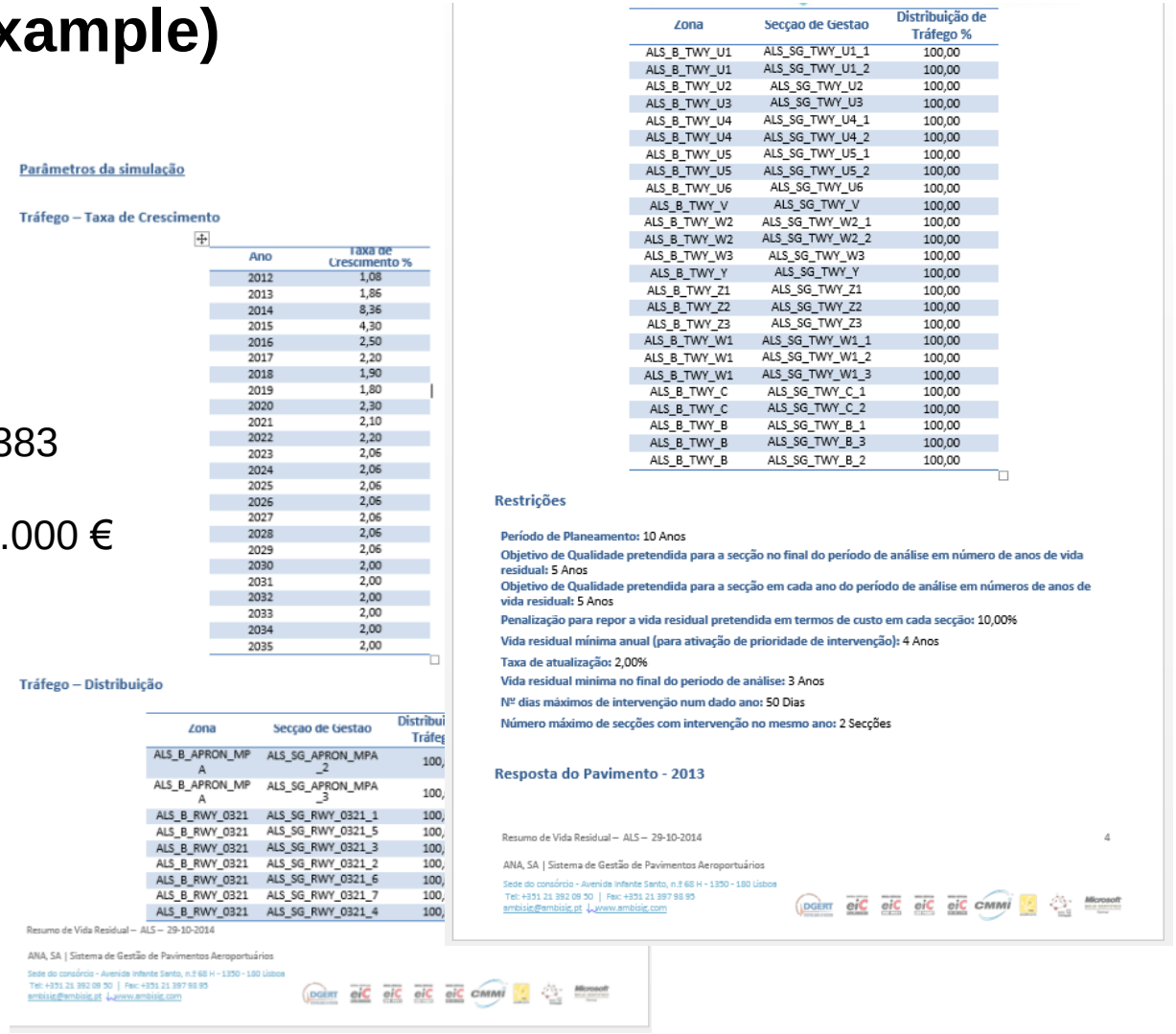
Year 10



AID-DECISION FRAMEWORK

- **Simulation results (example)**

  - **Automatic Reports**
  - **Summary**
    - Number of interventions: 383
    - Maintenance costs: 6.500.000 €



Parâmetros da simulação

Tráfego – Taxa de Crescimento

Ano	Taxa de Crescimento %
2012	1,08
2013	1,86
2014	8,36
2015	4,30
2016	2,50
2017	2,20
2018	1,90
2019	1,80
2020	2,30
2021	2,10
2022	2,20
2023	2,06
2024	2,06
2025	2,06
2026	2,06
2027	2,06
2028	2,06
2029	2,06
2030	2,00
2031	2,00
2032	2,00
2033	2,00
2034	2,00
2035	2,00

Tráfego – Distribuição

Zona	Secçao de Gestao	Distribuição de Tráfego %
ALS_B_APRON_MPA	ALS_SG_APRON_MPA_2	100,
ALS_B_APRON_MPA	ALS_SG_APRON_MPA_3	100,
ALS_B_RWY_0321	ALS_SG_RWY_0321_1	100,
ALS_B_RWY_0321	ALS_SG_RWY_0321_5	100,
ALS_B_RWY_0321	ALS_SG_RWY_0321_3	100,
ALS_B_RWY_0321	ALS_SG_RWY_0321_2	100,
ALS_B_RWY_0321	ALS_SG_RWY_0321_6	100,
ALS_B_RWY_0321	ALS_SG_RWY_0321_7	100,
ALS_B_RWY_0321	ALS_SG_RWY_0321_4	100,

Resumo de Vida Residual – ALS – 29-10-2014

ANA, SA | Sistema de Gestão de Pavimentos Aeroportuários

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Zona	Secçao de Gestao	Distribuição de Tráfego %
ALS_B_TWY_U1	ALS_SG_TWY_U1_1	100,00
ALS_B_TWY_U1	ALS_SG_TWY_U1_2	100,00
ALS_B_TWY_U2	ALS_SG_TWY_U2	100,00
ALS_B_TWY_U3	ALS_SG_TWY_U3	100,00
ALS_B_TWY_U4	ALS_SG_TWY_U4_1	100,00
ALS_B_TWY_U4	ALS_SG_TWY_U4_2	100,00
ALS_B_TWY_U5	ALS_SG_TWY_U5_1	100,00
ALS_B_TWY_U5	ALS_SG_TWY_U5_2	100,00
ALS_B_TWY_U6	ALS_SG_TWY_U6	100,00
ALS_B_TWY_V	ALS_SG_TWY_V	100,00
ALS_B_TWY_W2	ALS_SG_TWY_W2_1	100,00
ALS_B_TWY_W2	ALS_SG_TWY_W2_2	100,00
ALS_B_TWY_W3	ALS_SG_TWY_W3	100,00
ALS_B_TWY_Y	ALS_SG_TWY_Y	100,00
ALS_B_TWY_Z1	ALS_SG_TWY_Z1	100,00
ALS_B_TWY_Z2	ALS_SG_TWY_Z2	100,00
ALS_B_TWY_Z3	ALS_SG_TWY_Z3	100,00
ALS_B_TWY_W1	ALS_SG_TWY_W1_1	100,00
ALS_B_TWY_W1	ALS_SG_TWY_W1_2	100,00
ALS_B_TWY_W1	ALS_SG_TWY_W1_3	100,00
ALS_B_TWY_C	ALS_SG_TWY_C_1	100,00
ALS_B_TWY_C	ALS_SG_TWY_C_2	100,00
ALS_B_TWY_B	ALS_SG_TWY_B_1	100,00
ALS_B_TWY_B	ALS_SG_TWY_B_3	100,00
ALS_B_TWY_B	ALS_SG_TWY_B_2	100,00

Restrições

Período de Planeamento: 10 Anos
Objetivo de Qualidade pretendida para a secção no final do período de análise em número de anos de vida residual: 5 Anos
Objetivo de Qualidade pretendida para a secção em cada ano do período de análise em números de anos de vida residual: 5 Anos
Penalização para repor a vida residual pretendida em termos de custo em cada secção: 10,00%
Vida residual mínima anual (para ativação de prioridade de intervenção): 4 Anos
Taxa de atualização: 2,00%
Vida residual minima no final do periodo de análise: 3 Anos
Nº dias máximos de intervenção num dado ano: 50 Dias
Número máximo de secções com intervenção no mesmo ano: 2 Secções

Resposta do Pavimento - 2013

Resumo de Vida Residual – ALS – 29-10-2014 4

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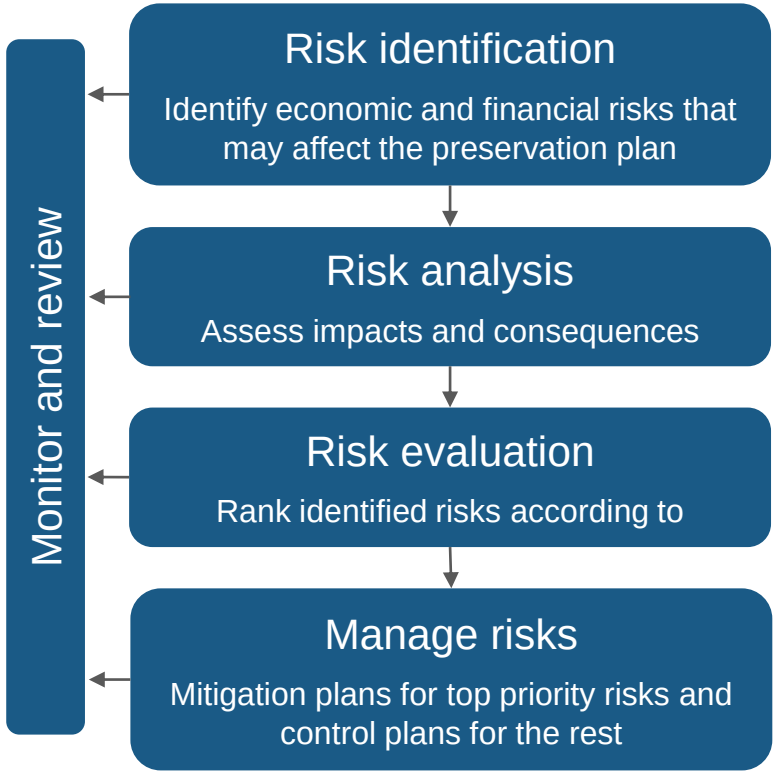
FINAL REMARKS

- While PMS are currently capable of providing insightful considerations for the tactical application of the preservation plan, they are not able to adequately deal with uncertainties inherent to the real-world strategic decisions.
- Funding needs along with budget cuts and other economic uncertainties affect the preservation plan and, therefore, must be considered in new emerging tools.
- Addressing financial risks will enable any manager to compete for funding and adapt the maintenance plan accordingly.



A successful decision support tool requires a comprehensive approach capable of incorporating inputs from across all decision levels while managing the risks that may undermine the complete preservation plan. Planning with flexibility to adjust to different situations is the key issue for the next generation of PMS.

FINAL REMARKS

Thank you for your attention

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