Road maintenance policy based on an expert asset management system

- Concept and case study -

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Outline of the presentation

- Road asset impacts rating
- Road asset maintenance programing
- Maintenance strategies
- Life cycle simulation
- Case study

Road maintenance impact rating

- Maintenance activities impact all road stakeholders : Financers, Agencies, Users, Neighbors, Society…
- Need for ratings (or Key Performance Indicators – KPIs) to quantify these impacts.
- KPIs are criteria to assess and therefore to decide maintenance strategies.
- KPIs are aggregation and combination of elementary data

Road maintenance impact rating

- “Road Condition” is synthetic KPIs which reflect impacts on financers, agencies and users.
- Most countries are using some kind of PCI or PSI.
- France is using two indicators (Structure, Surface) which varies from 0 (ruin) to 20 (as-new).
- KPIs are often irrelevant for diagnosis and suggestions of remedial measures (critical information lost during the aggregation process)

Road maintenance programing

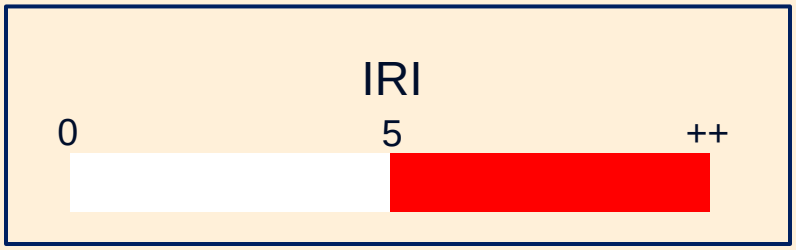
- When, where and how should be the numerous network sections maintained ?

- With a given periodicity ?
  - Sometimes used at the design stage, but not very realistic
  - Rarely applied

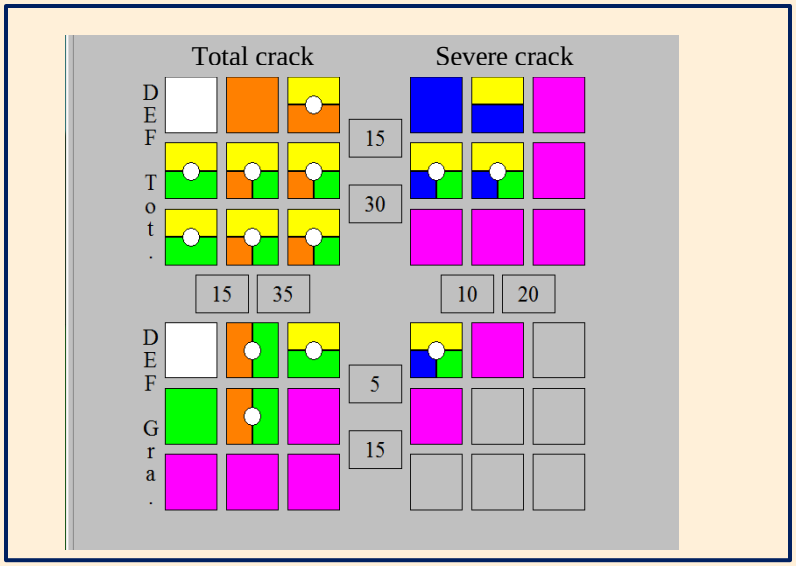
- Depending on the section condition ?
  - Applies some strategies that define the need and priority of road works depending on road type, road condition, traffic, climate…

Maintenance strategies

- From a very simple one
  - ❑ If IRI < 5 No intervention
  - ❑ If IRI > 5 Overlay (traffic)



- To multi-criteria grids
  - Depending on cross analysis of extension of several distresses



- To expert strategies
  - Algorithms

Strat_C

- Test déflexion
- Déflexion mauvaise
- Déflexion bonne
  - NT
    - Def/F_Thermique
    - Def/F_Fatigue
    - Arrach
  - GB
  - GH ou MIX
  - Fusion
- Epaisseurs

Dupliquer

Nouveau (même niveau)

Nouveau (niveau inférieur)

Renommer | Supprimer

Monter | Descendre

Ouvrir l'arbre | Fermer l'arbre

Conditions

Description

```
SI (DEFT>0 OU F_TH>0)

# Pas de deformations graves
SI (DEFG=0)
T1_4=GRILLE_XY_A(2,3,DEFT,F_TH,\
0,10,100,\
0,10,50,100,\
"","ReparLoc+BBTM","ReparLoc+ECF+BBTM",\
"BBM","BBM","BBM")
FIN

# Il y a des deformations graves
SINON
T1_4=GRILLE_XY_A(2,3,DEFT,F_TH,\
0,10,100,\
0,10,50,100,\
"ReparLoc+Colma","ReparLoc+BBTM","ReparLoc+ECF+BBTM",\
"FRAIS+BBSG","FRAIS+BBSG","FRAIS+BBSG")
FINSI

FINSI

SI (F_TH=0)
T1_4=SUPPRIMER_TACHE(T1_4,"ReparLoc")
T1_4=SUPPRIMER_TACHE(T1_4,"Colma")
FINSI

SI (FLTOT=0) T1_4=SUPPRIMER_TACHE(T1_4,"Colma")
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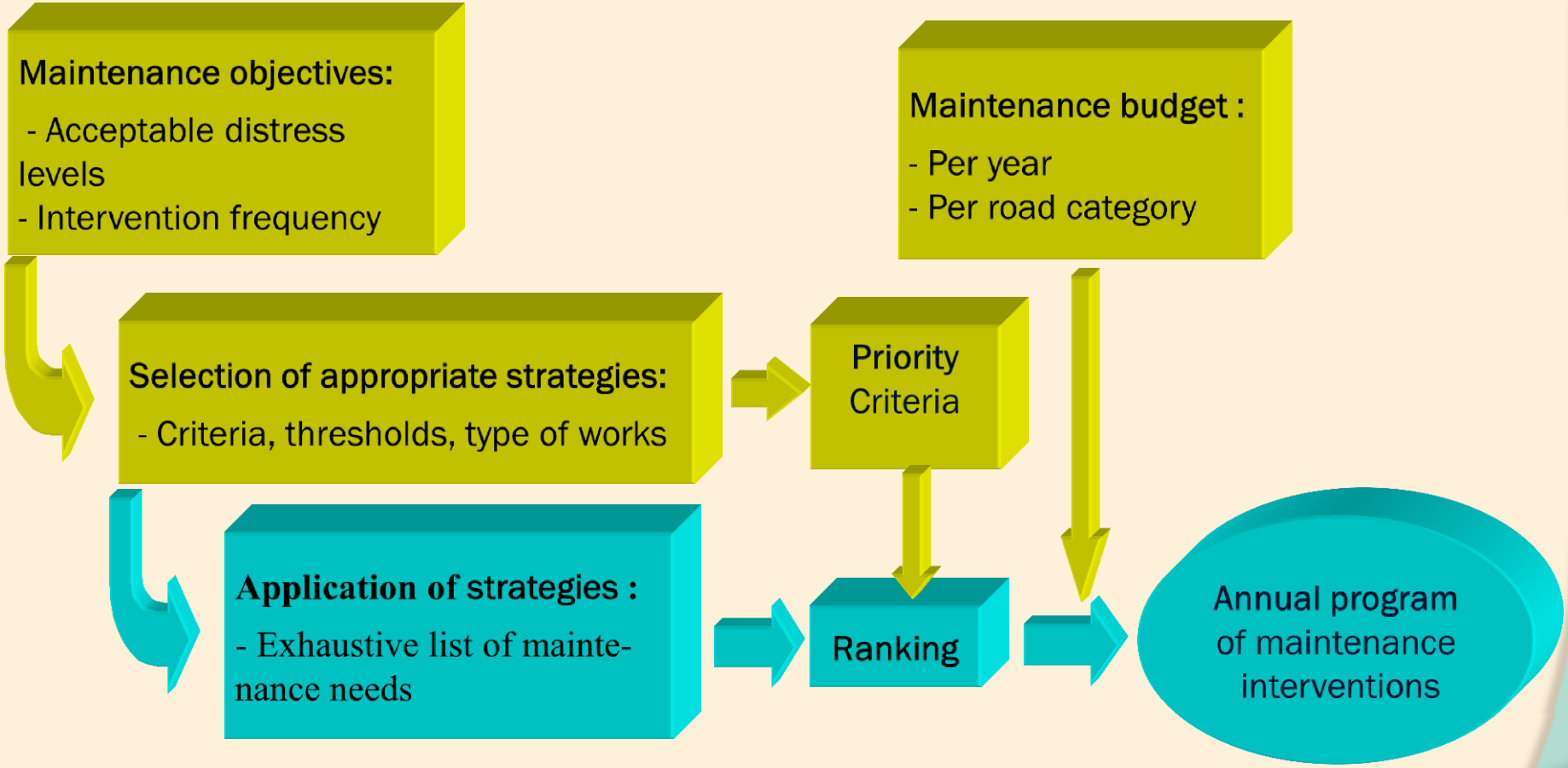
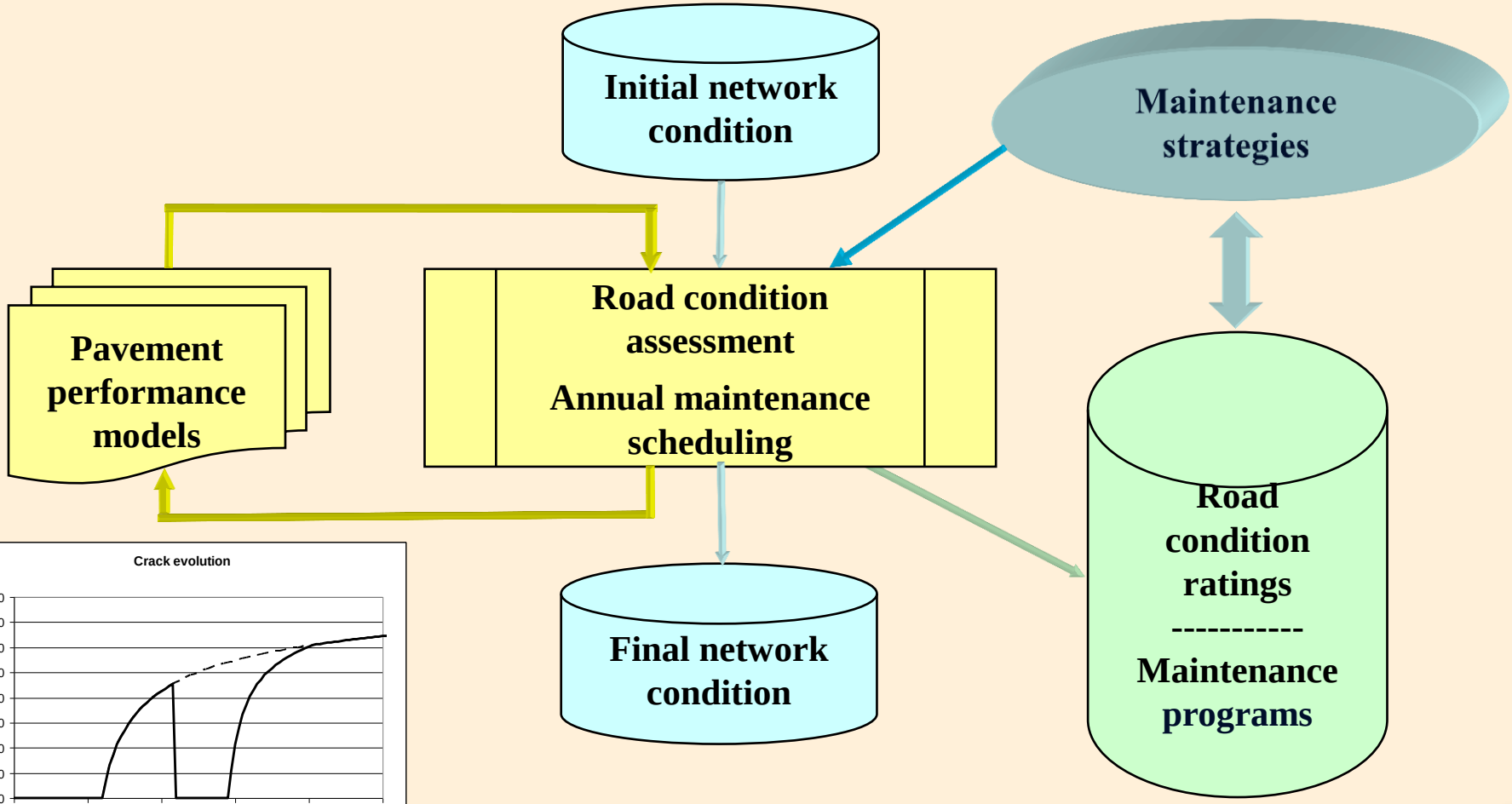
Substitution de technique | Multiplication des seuils | << | >> | Export HTML | Aide | OK | Annuler

Maintenance Strategies



Life cycle simulation

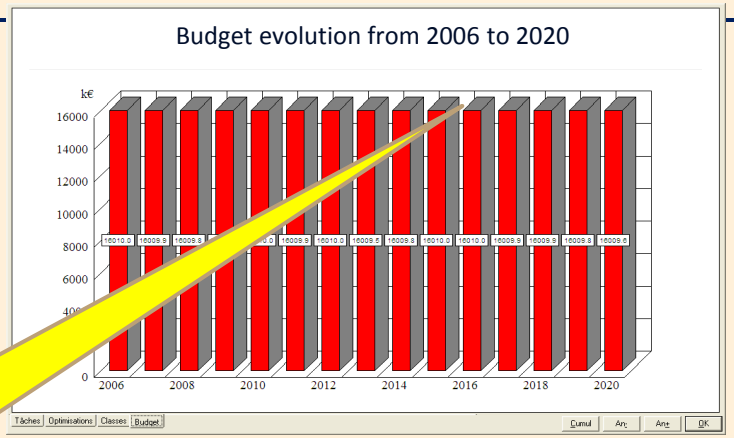


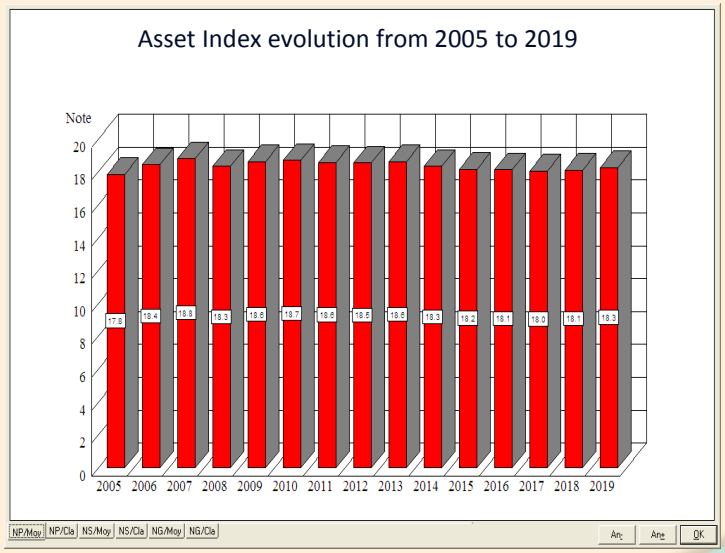
Case study

- 2 500 km of roadways
- Located in west of France
- Data available from 2005
- Rather homogeneous in functions
- A “reference” strategy technically sound
- A “reference” strategy applied to the whole network
- Simulation over 15 years

Case study

- ✓ Reference strategy
- ✓ Overall budget of 0.85€/m² (~ US$ 0.09/ft²)

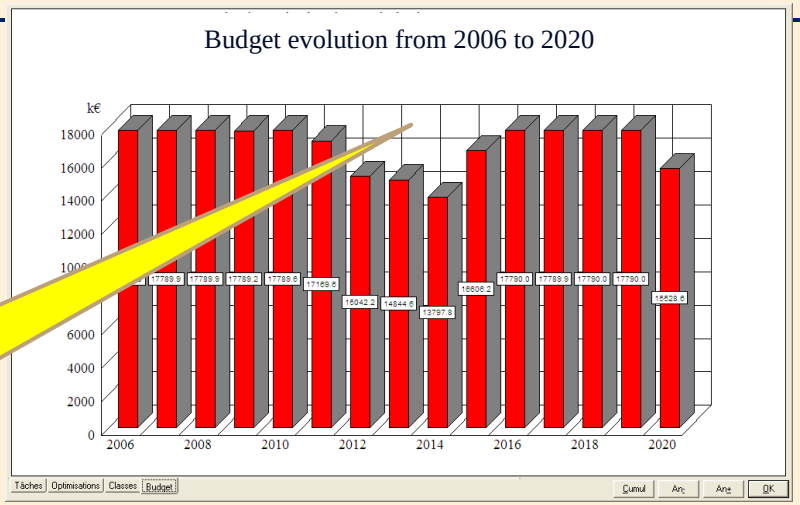


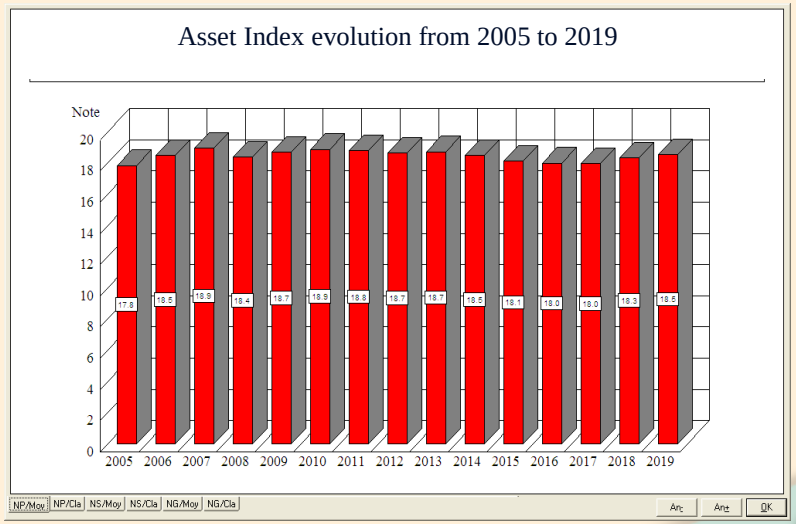


- All budget is employed
- Condition indicator slightly increase from 17 to 18

Case study

- ✓ Reference strategy
- ✓ Overall budget of 0.95€/m² (~ US$ 0.11/ft²)





- Not all budget is employed (not enough distresses)
- Condition indicator slightly increase from 17 to 18

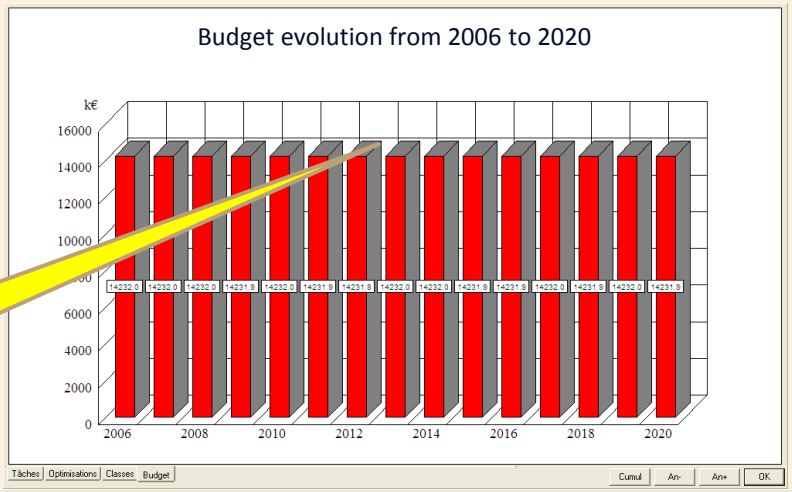
➔ Too high annual budget for the reference strategy

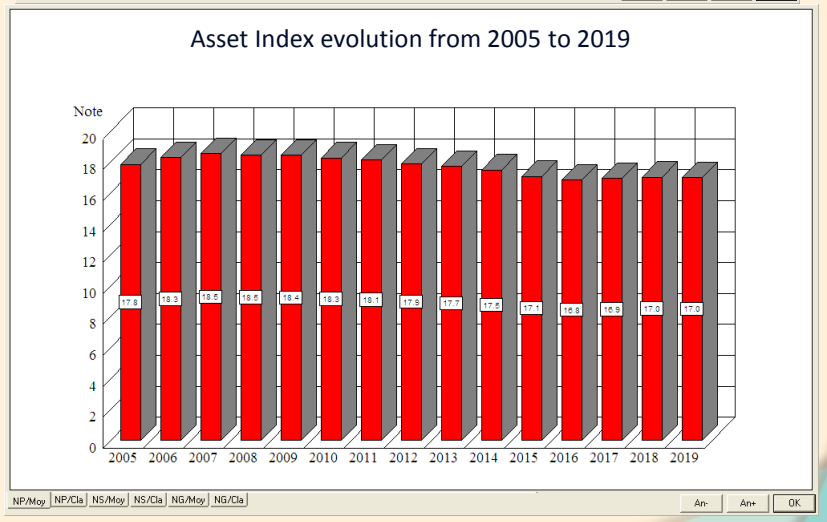
Case study

- ✓ Reference strategy everywhere
- ✓ Overall budget of 0.75€/m² (~ US$ 0.08/ft²)

- All budget employed
- Condition rating decrease from 17 to 16,5

➔ Insufficient budget for the reference strategy





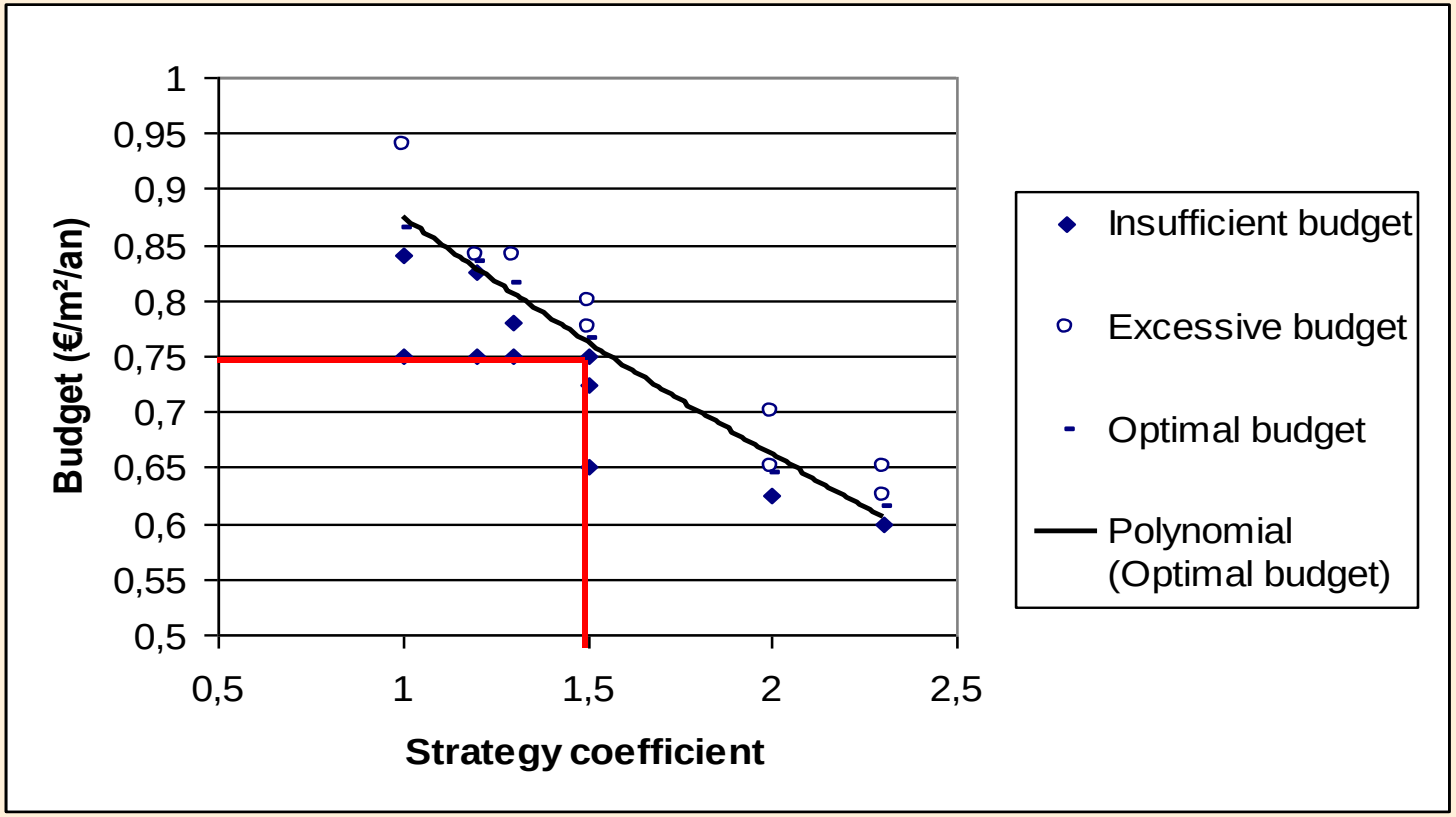
Case study

The optimal budget for the reference strategy is about 0.85 €/m² (~ US$ 0.09/ft²)

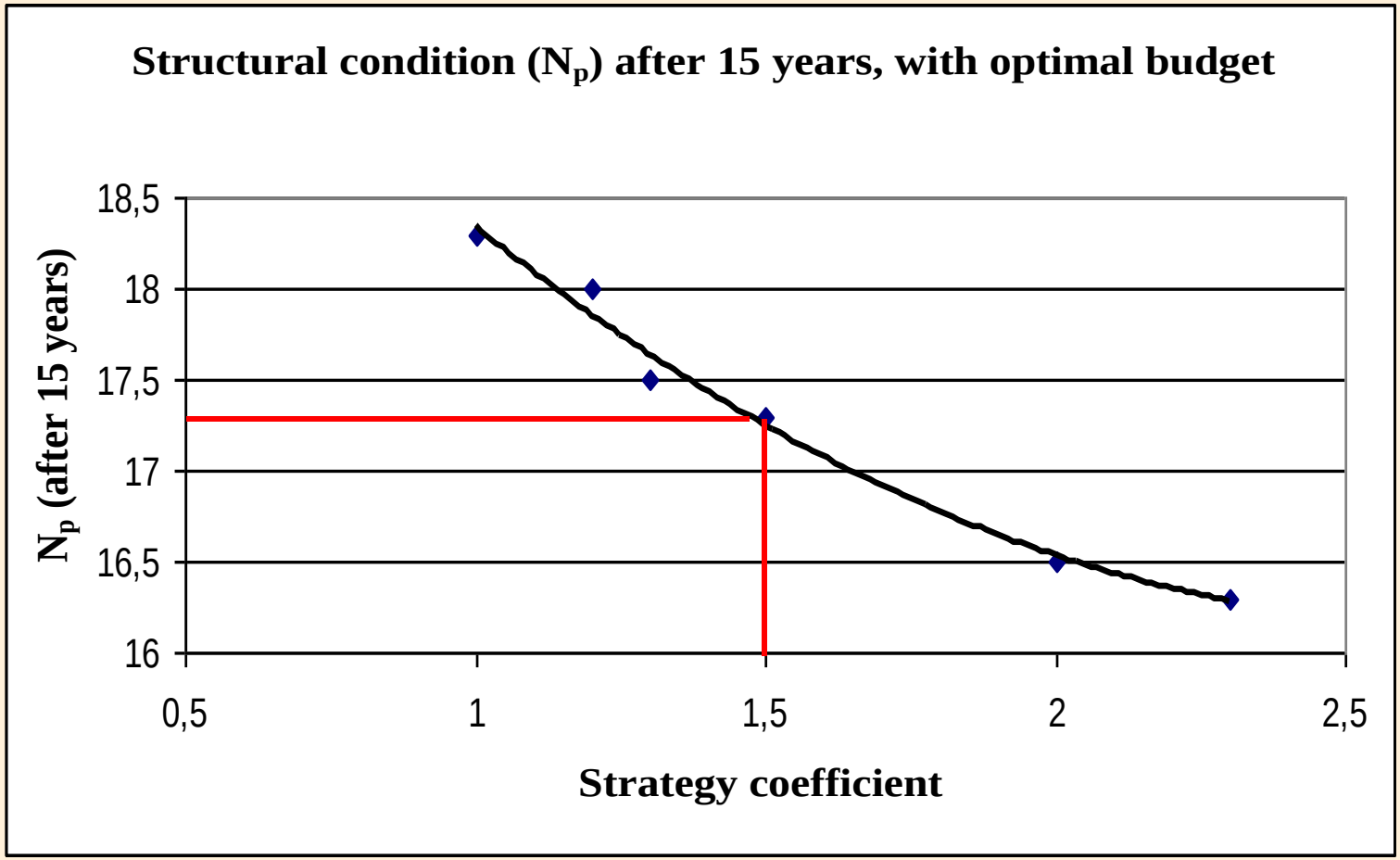
- A new strategy is generated by multiplying all thresholds by 1.5
  ➔ It should allow more distresses before an intervention is triggered
  ➔ It should triggered less interventions
  ➔ It should required less budget.
- The same approach is conducted. The optimal budget is about 0.75€/m² (~ US$ 0.08/ft²)

Case study

Optimal budget for a given strategy



Case study


Structural condition (N_p) after 15 years, with optimal budget
N_p (after 15 years)
18,5
18
17,5
17
16,5
16
0,5
1
1,5
2
2,5
Strategy coefficient

Conclusions

1. We defined flexible maintenance strategies deriving interventions from real road condition
2. We were able to assess the impact of this strategy over 15 years by a medium or long term simulation
3. It was then possible to compare different strategy and find an optimum, for a given type of impact
4. The various strategy were tested within a given family (by only varying thresholds); more different strategies can be compared as well.

Conclusions

5. Comparison criteria was the impact on road condition; other criteria can be used as well.
6. Especially, socio-economic and/or environmental criteria can be used
7. The same method used for strategy analysis is applied for maintenance programming ➔ full consistency.