

Leading-Edge Asset Management

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"Average Network Age Index" (NAX)

Explanatory Factor for Mains Failures and Water Losses

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- NAX in the Austrian Benchmarking
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The Austrian benchmarking





Client: OVGW based on the IWA PIs enhanced and adapted developed by universities voluntary and anonymous cooperation with EffWB



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The Importance of the Assessment of Influencing Factors

Determination of influencing factors is crucial:

- to the goal of high quality benchmarking
- achieve a better estimation whether some PIs of one utility are in a good or in a poor range

Sub-grouping

- see differences between peer groups very clear
- best practices can be determined



Influencing Factors (ii)

The most important influencing factors:

- unchangeable structural parameter: urbanity
- the age of the pipe network
- IWA "Average Mains Age" (# CI53) ask for average age of total network
- problem: different pipe materials have different expected lifetime



Development of Average Network Age Index NAX - Background

...To have a tool for grouping utilities and an additional explanatory factor:

- according to network age
- based on expired service life

... for evaluation of mains failures and water losses



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NAX - taking into account service life

- based on the age of each main and its length (similar to IWA "Average Mains Age")
- reference age incorporates expected service life of each different material groups

reference age based on:

- literature values (Fuchs, 2001; DVGW W 401)
- expert opinions of Austrian project group



NAX - calculation

NAX = $\Sigma Li * Aact, i / Aref, i$ [%] for i = 1 to n

L ...network length-share of material group [%]
Aact ...actual average age of material group [years]
Aref ...reference age of material group [years]
n ...number of material groups



NAX - material groups (12)

- asbestos cement
- reinforced concrete
- glass-fiber reinforced plastic (GRP)
- cast iron (gray iron) (CI)
- ductile graphite iron "old" without protection against corrosion and without cement lining (until mid of the 1970th)
- ductile graphite iron "new" with galvanizing against corrosion and cement lining (starting from mid 1970th)
- polyethylene (PE)
- polyvinyl chloride (PVC)
- steel "old" without lining (until end of the 1970th)
- steel "new" with cement lining and outer PE casing
- renovation (e.g. inlining)
- other pipe materials



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Considerations Concerning the Reference Age

- reference age is rather an empirical value
- reference age is the age when the mains typically start to cause major problems and should be replaced

influenced by many factors:

- national differences (directives and standardisations)
- regional differences (surroundings and soil structure)
- Iocal differences (subsidence and static and dynamic loads)



Considerations Concerning the Composition of the Index Value

- the index should be a far-spread composition of very new parts medium aged parts and old parts of network, (next to being exchanged)...
- Networks with a homogenous relative age may result in a bulk-renewal.
- A cost-trap might be waiting even if the actual age index is low at present.



Possible Applications of NAX

Grouping utilities according to their network age – age + urbanity to define peer groups for failure rates and leakage!

NAX as an explanatory factor – for any PIs dealing with failure rates and losses.

Eliminating the influence of the assets age -

- other influencing factors can be found and quantified
- the possibility of sub-grouping increases the significance of differences between peer groups



Using NAX in the Austrian **Benchmarking - Examples**

...grouping utilities according to the age structure of their assets

- NAX is less than 40 %
- NAX is 40 % to 60 %
- NAX is more than 60 % \rightarrow old network
- \rightarrow young network
- \rightarrow medium network



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Water losses per Connection and Day





Water losses - ILI





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Mains failures – sub grouping



Exception: metropolitan utilities have even lower mains failures

However: water losses show a steady increase with urbanity

Assumption: bursts in metropolitan networks not found easily due to background noise

...resulting in **higher leakage** and **lower mains failures** (found and fixed) at the same time



Conclusion

Strongest influencing factor concerning mains failures and water losses:

urbanity and age of the pipe network.

Calculation of the average mains age does not consider different service lives

- The NAX does and
- provides an estimation of how much of the expected service life has elapsed



Conclusion (ii) - NAX can be used ...

- as an explanatory factor for PIs dealing with failure rates and water losses;
- as a parameter to define peer groups
- to estimate the influence of network age on asset related performance indicators
- Iong term trend of NAX indicates rehabilitation level



"Average Network Age Index" (NAX)

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Thank you for your interest and attention



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