AWARE-P: a system-based software for urban water IAM

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AAREP» Software system

- The AWARE-P IAM software system materialized several years of utility-driven R&D in a structure developed in order to host the range of tools identified as central to the analyses and decision support involved in the IAM planning process.
- The public beta release in early 2012 garnered a good number of users worldwide.
- Subsequent versions and a growing number of utility deployments and pilots (USA, Norway, Spain and Portugal, among others) have been steadily confirming the potential of its system-based approach.

AVAREP» Around the world



ANAREP» IAM at each planning level



AVAREP» The planning process: problem-driven



<u>C 001</u>	<u>C 002</u>	<u>C 003</u>	<u>P 01</u>	<u>P 02</u>	<u>P 03</u>	<u>P_04</u>	<u>R 1</u>

for the current system...



	<u>C 001</u>	<u>C 002</u>	<u>C 003</u>	<u>P_01</u>	<u>P_02</u>	<u>P 03</u>	<u>P_04</u>	<u>R 1</u>
<u>A.0</u>			•		٠	٠	•	٠

for each planning alternative...





AAREP» IAM design guidelines

-the "art of balancing performance, cost and risk in the long term".
 - Brown and Humphrey (2005)

• Systems, not collections of assets

• Long-term evaluation: as a whole, these infrastructures have an indefinite life span



LEYP aggregated results, estimated parameters and significance test

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Formula

AAREP» The software

- Designed as a non-intrusive, web-based, collaborative environment to integrate IAM data, processes, objectives, metrics and decisions;
- Capable of assessing and accounting for individual as well as system behavior.
- Offers the ability to collect available data and information from a large variety of sources and processes that may be relevant to the IAM decision-making process, including:
 - maps, GIS shapefiles and geodatabases; asset registers; work orders, maintenance, inspections/CCTV records; network models; performance indicators; asset valuation records, among others

AAREP» Technology at a glance

- Web-based
- Modular, made to grow
- Client-server
 - cloud / corporate / local
- Multi–user
- Multi-platform
 - PC, Mac, iPad, linux
 - Laptop, tablet
- Compatible with existing SI





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- ADMINISTRATIO
- Users
- Data Type Manager

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AAREP» System and toolset



Data integration NETWORK - network level diagnosis PLAN - decision-making environment

Performance metrics analysis tools

Risk metrics analysis tools

Cost metrics analysis tools

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Buildings © 2008 3D Cities SA © 2012 Cnes/Spot Image Image © 2012 GeoEye

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		TASKS: 0	SINGLE USER
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Data Ranking 3D Cube	Edit Metric		
D Plan	Type Performance \$		
Alternatives	Code		
Metrics	Name Real losses per service connection		Analysis
P_%asbestos % asbestos cement pipes Cap. Inv. Capital Investment Cost Cap.	Description A performance indicator of real losses per service connection. The volume of real losses was estimated using the ILI (Infrastructure Leakage Index), calculated externally.	21	2026 2
C_IVI high IVI high values P	%	37.24	37.24
C_IVI low IVI low values %	as Red in this metric will make alternative red overall	0.74	0.74
P_Losses Real losses per service connection C	Targets 0.00 100.00 150.00 500.00	0.00	0.00
P_Pmin PX min pressure, normal operation P_Pmin cty PX min pressure, contingency operation	44 Ve 3	3.00	3.00
R_Risk Expected reduced service due to pipe failure	2	0.41 3.00	0.35 3.00
ADD METRIC		0.41 1.73	0.35
File info P.	L 0 100 150 500	16.00	116.00
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Plan data and rankings can be exported to and imported from Excel spreadsheets. Imported data will replace existing values; please try exporting first, editing data on Please try exporting first, editing data on	P CANCEL DELETE SAVE	2.88 2.88	2.88
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Tools

Define strategic objectives, metrics and targets

The selection of objectives requires a long-term vision and proficient knowledge of both external and internal contexts. Once those have been established, it is crucial to select appropriate metrics and define targets that will drive the whole planning effort.

Strategic diagnosis

Diagnosis entails assessing the existing infrastructure at present and through the planning horizon, in light of the established objectives. The metrics must be evaluated and compared to the targets. External context may drive the consideration of diverse scenarios.

Select strategies

Based on the present situation and long-term targets, different strategies will be considered, assessed, compared and ranked, both at present and through the planning horizon.

Monitor implementation

The system of metrics and targets is further used to monitor the implementation of strategies and support the periodic review of the plan.



PI incorporates a set of objective-oriented reference PI libraries, covering a wide range of aspects. IVI and PX provide additional ranges of metrics in the form of technical and infrastructural indices. This offer provides a rich starting point, but PI also allows the user to define her own objective-oriented PI libraries.



PI/IVI/PX provide the means to assess the selected set of metrics. PLAN is a framework to express their evolution through the planning horizon, including the incorporation of targets and the organization of scenarios. Externally estimated metrics may also be used. FAIL may be used to support inventory analysis.



Various alternative strategies are assessed in PI/IVI/PX and compared in PLAN, again using the chosen system of metrics. FIN may be used to assess their financial planning.



Stages

Tools



ANAREP» Availability

- Open-source, public access at <u>www.baseform.org</u>
- Professional versions and support available from project partner



Thank you



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Aware / Performance Indicator: Alt3 new run

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<u>m</u> SINGLE USER \otimes Performance Indicator: Alt3 new run Indicators Timesteps 70 PIs Summary Find and select PIs for your cart File name Alt3 new run SEARCH Objectives / Criteria + Folder Alternative 2 Name Owner single user Fi11 - Other costs Size 0 rows Fi25 - Unit investment Water supply PI library -PI library IWA Fi26 - Investments for new assets and reinforcement of existing assets OPEN IN DATA MANAGER Fi27 - Investments for asset replacement and renovation Fi28 - Average water charges for direct consumption PI Cart Fi29 - Average water charges for exported water Fi30 - Total cost coverage ratio Fi26 Investments for new assets and reinforcement of existing assets Fi31 - Operating cost coverage ratio **Op16** Mains rehabilitation Fi4 - Unit total costs QS13 Water interruptions Fi40 - Debt equity ratio Fi46 - Non-revenue water by volume Input variables required Fi5 - Unit running costs C8 Mains length Fi7 - Internal manpower costs D20 Mains rehabilitation Op12 - Emergency power system inspections D35 Water interruptions Op16 - Mains rehabilitation F1 Population supplied Op17 - Mains renovation G32 Investment in tangible assets Op18 - Mains replacement G33 Investments for new assets and Op19 - Replaced valves reinforcement of existing assets Op20 - Service connection rehabilitation H1 Assessment period Op23 - Water losses per connection Op24 - Water losses per mains length On27 - Real losses ner connection

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Aware / Failure analysis: Alternative 2 Failure analysis

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Failure analysis: Alternative 2 Failure analysis

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File name	Alternative 2 Failure	Year 20	031	JPDATE					
Folder	Alternative 2	Materi	al α	δ	β ₀	β_{diam}	β _{ILen}	Fails. per year	Fails./km per year
Owner	single user	FF	0.0000	0.0000	101.1552	-0.6617	-63,7024	0.00	0.00
Size	11482 rows		0.1284	0.1272	0.6123	0.1260	0.0543		
Work Order Pipes	Pipes database A2 t5	FG	0.0000	1.5410	-9.8545	0.0234	0.6342	1.20	0.48
Work Order	Epilures database A2 t5		0.9999	0.5322	0.0039	0.3909	0.0302		
Failures		FD	6.9695	0.5402	-5.1167	-0.0007	0.3525	1.23	0.12
OPEN IN DATA	A MANAGER		0.0180	0.1375	0.0000	0.7223	0.0145		
	-t-	PEA	5.8924	0.5759	-5.3204	-0.0043	0.5626	37.73	0.29
Model I	110		0.0000	0.0000	0.0000	0.0000	0.0000		
		FC	1.7160	0.7499	-4.2285	-0.0023	0.3578	187.72	1.70
			0.0000	0.0069	0.0000	0.0000	0.0000		
		PVC	1.7441	0.7040	-5.3085	-0.0020	0.5652	59.23	0.52
			0.0000	0.0000	0.0000	0.0837	0.0000		

Pipe ID	Failure Rate	Failure Probability
815102	2.7346	91.0%
14180	3.3388	89.8%
11295	1.9259	83.8%
1123090	1.8222	81.8%
10711	1.8130	79.2%
11370	1.6338	77.2%
10922	1.5801	76.2%



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127 🗋 demo app / IVI: IVI2_ex1 🛛 🗙 🐠 🏡 📮 ≡ ← → C ☆ □ 127.0.0.1:8080/?open_ivi=201 SINGLE USER TASKS: 0 \otimes IVI: IVI2_ex1 Analysis Cost data Simulation Initial IVI 0.66 Initial rehab rost 3,653.20 2013 Start year Initial rehab rate 0.01 2050 End year Variable Rehab rate ÷ 1.010 4,000.00 € Reference value 1.0 1.00 1.005 Replace expired 📃 3,000.00 € 0.75 RUN SIMULATION 1.000 2,000.00 € 0.50 **File info** Model info 0.995 1,000.00 € 0.25 0.00€ 0.990 0.00 2015 2020 2025 2030 2035 2050 2040 2045 🔳 Target Rehab rate 📒 IVI 📕 Rehab cost 📕 Rehab rate

Analysis data

	IVI	Rehab Cost (€)	Rehab rate (%)
2013	0.66	3,653.20	0.01
2014	0.65	3,646.50	0.01
2015	0.65	3,630.10	0.01
2016	0.65	3,617.20	0.01
2017	0.64	3,618.70	0.01
2018	0.64	3,675.30	0.01



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Data	<u>Name</u>	Туре	Modified	Size
Network	Alternative 0	Epanet INP File	2012/04/04	83 kB
Plan	Alternative 0 Comp Imp	Component Importance Table	2012/04/04	0 rows
	Alternative 0 emergency	Epanet INP File	2012/04/04	83 kB
PERFORMANCE	Alternative 0 emergency Pmin	Performance Index Table	2012/04/04	14251 rows
Indicators	Alternative 0 Failure analysis	Failure Analysis Table	2012/04/04	11481 rows
Indices	Alternative 0 IVI	Cost Table	2012/04/04	459 rows
RISK	Alternative 0 PI	Performance Indicator Table	2012/04/04	45 rows
Failure Analysis	I Alternative 0 Pmin	Performance Index Table	2012/04/04	14251 rows
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000 Aware / Model: Alternative 2 C Q. Google m + >> http://127.0.0.1:8080/?loadEpanetFile=283 SINGLE USER \otimes Model: Alternative 2 Chart & Scale Visualization Model Summary 🕂 🕂 🕄 — Layers ₩ OpenStreetMap ‡ 🔘 🗹 Junctions (567) 👿 🗹 Reservoirs (2) 🗹 Tanks (0) 🛏 🗹 Links (602) O Vertical Pumps (0) Valves (143) Specify below the <u>EPSG code</u> to define source file projection on the map Rua Dr. Roa Antó Rua Alexandre Hercu φ Rua da Ribeira EPSG 3763 OK TUB Antonio Sa FARMÁCIA CLABEL Simulation Ceuta DNEL Last simulation: 2012/05/24 13:55:30 Duration 24:00:00 P Pattern time step 15 minutes ÷ Hydraulic time step 15 minutes ÷ Quality time step 15 minutes ÷ abro Praceta

