Marcell Knolmár:

Computer Aided Sewer Design

Dissertation (PhD)
Summary

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1. Computer Aided Design System for Sewer Network

The combined and separated sewer networks are connected to the natural and built environment at several points, primarily to the hydrological systems and to the urban water management systems. On **Figure 1** those connections of a **sewer network** are highlighted which are essential in the point of view of the **solutions** of the selected actual problems. The **selection is carried out** in **Section 3** and are **analyzed more detailed further** in the dissertation. Additional possible connections (e.g. with the wastewater treatment plant, groundwater, receiving water bodies) drawn by dashed lines. In case of the subcatchments of the sewer network the connection with the precipitation was analyzed more detailed too, because the quantitative analysis of the sewer network is mainly determined by rainfall load. Additional connections were indicated (e.g. evapotranspiration) on the figure.

In the first column ("Sewer network") of **Figure 1** the elements and processes needed to the solutions of the problems examined more detailed in my dissertation are selected. The **sewer network** is the basic elements of the system, which is including conduits, manholes and control elements (reservoirs, pumping stations, overflows) determining the behavior of the system. In case of separated and combined sewers the **rainfall runoff discharge from the subcatchments** means **the main quantity** of the load. The sewage deriving from communal, industrial and other concentrated point sources are significant in water quality, sewage treatment point of view. The potential measurement is indicated on **Figure 1**.

The runoff from the catchments means the boundary condition of the sewer network, which can be hardly measured directly. The **rainfall** means the indirect load of the sewer network, which is analyzed more detailed in my dissertation. The additional possible measurements for the subcatchments (e.g. soil parameters) are indicated on the figure.

Measurements of the **flow conditions** developing in the sewer networks (depth, velocity, discharge) mean the other practically and theoretically important task regarding to the sewer network. The parallel monitoring of flow conditions and rainfall loads are important first of all for the calibration of the **hydrodynamic model**. The additional measurement possibilities regarding the sewer network (sediment level, particle size distribution) are indicated on the figure.

The data used in the system should be store, manage, maintain. The different type of queries, lists should be produced regularly. The data coming from different sources (measurements, surveying, digitization etc.) mean the base of the designing, operational, sometimes modeling tasks. Besides the data regarding to the subcatchments and sewer network (geometric and hydraulic) should be capable to store the other type of data (e.g. groundwater surface level) in the same database.

The **modeling purposes** mean **one of the most important data demand** for the sewer network. On the one hand the subcatchment data determining the necessary runoff data, on the other hand the rainfall data resulting indirectly the discharge load via the subcatchment are needed too.

The quantity and quality the necessary data of the subcatchments are primarily specified by the **subcatchment runoff model** applied in the hydrodynamic model. The network data (e.g. geometry) are necessary for the 1 dimensional flow model f the sewer network. The data of the load can come as an output of the subcatchment runoff model, or from direct inflows (e.g. dry weather flow). The **hydrodynamic flow model is determining** the necessary data. Both of the runoff and the flow routing model data are coming from measurements or from other sources (maps, calculations, estimations). Additional models can be connected to the sewer network, besides the subcatchment and hydrodynamic models (e.g. infiltration-exfiltration, statical models for the pipe and the bed).

The **essential part of the dissertation** is the **CAD** (computer aided design) system, which is described quite detailed. The computer aided design can mean the design of new sewers, redesign and revising of existing sewers. The hydrodynamical, sediment transport and additional models and the data of the existing sewers can be used for this designing step. As a result of the design the data of the new or modified sewers are inserted or updated in the database of the sewer network. Therefore the **data flow of the designing process is two-directional type**.

In the selection of my topics the main focus is on the design, but I include also the solutions for some operational problems in the definition of the computer aided design. Unfortunately there is too light emphasis laid on the consideration of the operational issues in the Hungarian designing practice. If the connection between the design and operation is strong enough, I present the **solutions for the operational problems** at each element of the presented CAD system (e.g. data management, considerations for the morphological changes).

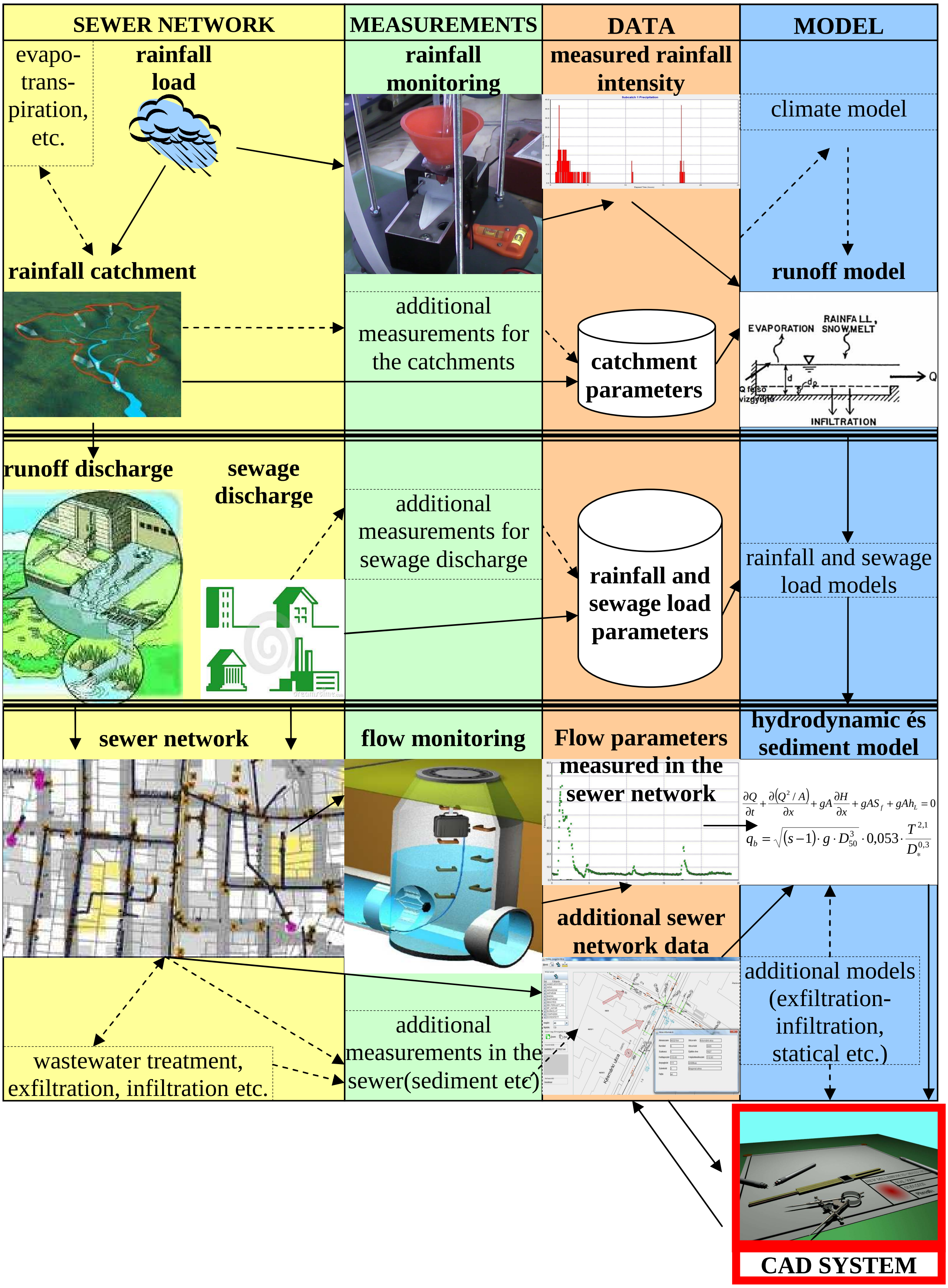
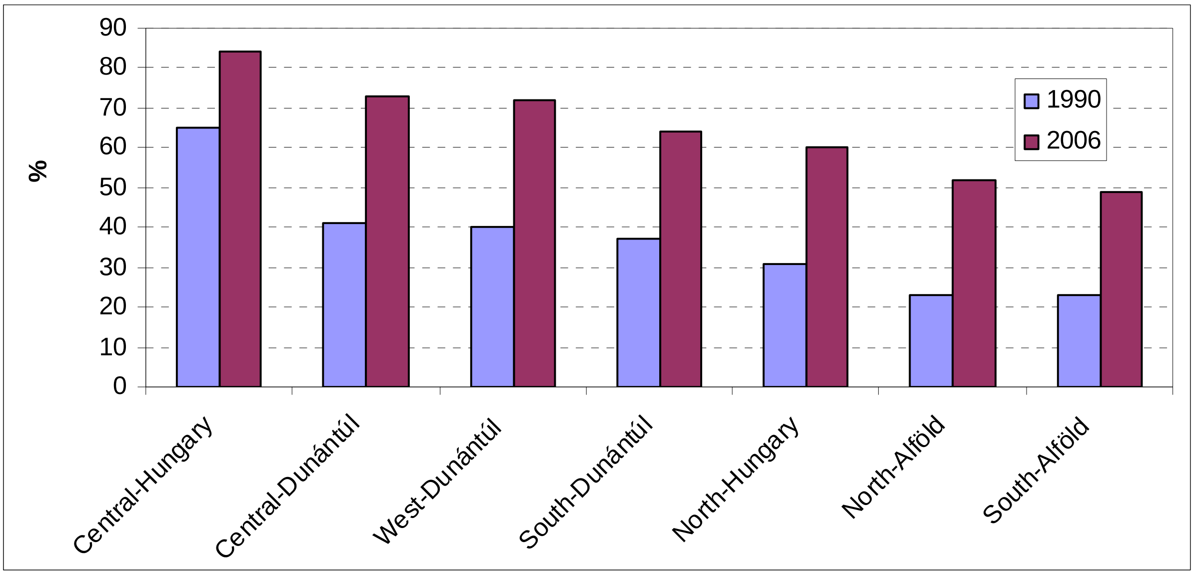


Figure 1. Computer aided sewer design system of sewer networks

2. Currant Problems in Sewer Design

Based on the sewerage data of Hungary *(Juhász, 2008)* it is still necessary to build new sewer networks, despite the increasing number of the sewer length built in one year. Mainly the eastern part of Hungary is underdeveloped (**Figure 3**). The main portion of the stormwater sewers are open channels, its urgent task to change to closed pipe systems. The rainfall should be desiccated into the ground, the impervious areas should be decreased. However building of new stormwater channels is anticipated. The combined system sewer network is frequently converted to separated networks. Based on these statements the design of new sanitary and storm networks is still actual task in the field of public works and nowadays this is unconditionally necessarily aided by computers. In the designing process the data management, the documentation process, the calculations can be helped by computing technique. The application of hydrological, hydrodynamical models can afford more complex approach of the design method, according to the sustainable development *(Gayer, 2004).*



2. ábra Rate of connected flats to the sewer network in 1990 and 2006-ban (Juhász, 2008)

Several problems can be outlined concerning with the **existing sewer networks**. One part of the sewer network is overloaded because of **hydraulical capacity deficit**. On cause of this deficit is the increased value of the load compared to the design value, the other reason is the abrasion of the sewer pipe material. The increased load can be the result of the permitted and forbidden house connections and infiltration from the groundwater. The wastewater and rainfall load volumes can be increased compared to the design value. Proportionally to the aging of the sewers the pipe wall friction, root intrusion, junction displacements and other structural failures can decrease the transport capacity of the sewers, the final break of the sewers can be reached continuously. In the final stage the collapse and blockage are absolutely terminating the basic function of the sewer, The rehabilitation, reconstruction, replacement of existing sewer networks is a currant civil engineering task, which is supported by the **model built for the existing state** (Saegrov…-Knolmár, 2006).

If the quantity problems are already solved, then the **quality problems of wastewater collection** and transporting systems are usually advancing. The receiving bodies are reached by the contamination **directly at combined sewer overflows** (CSO). The CSO structures should be designed or redesign based on the currant legislation. Pollution can reach the groundwater because of exfiltration in case of faulty built or aged pipes with lost imperviousness. The computer modeling of interaction between the receiving water and groundwater and the sewers can give help to solve **water quality problems**.

The water quality of the collected water arriving at the wastewater treatment plant (besides the water quality) is of essential importance in point of view of the efficiency of the wastewater treatment. The long travelling time is inducing odour problems and corrosion of structures. The **hydrodynamical modeling of the flow conditions in the sewer network** can help in the solution of the water quality problems.

Summarizing the actual tasks emerged in the field of the sewer network design (and operation):

- designing of new sewer networks,
- redesigning of existing sewer networks and
- plans for the operational actions.

Summarizing the actual demands for the application of computer emerged in the following categories:

- asset management and geographical information system (GIS),
- spatial design of new sewers, documentation and
- hydrodynamical and pollution transport calculations.

3. Selection of topics, targets

The most important steps of the wastewater and stormwater design are the followings: (*Horváth, 1985*; *Öllős, 1990*; *Sali, 1990; Darabos és Mészáros, 2006)*:

- determination of the quantity of sewage and stormwater
- hydraulical dimensioning of pipes
- spatial design of sewer pipes, manholes and other structures and appliances (alignment)
- statical design of pipes and beds
- documentation of plans

Detailed design manuals were prepared for the partial design areas *(Dulovics, 1975; Öllős, 1983*; *Bozóky-Szeszich, 1988; Dulovics Dné, 2003).*

The design process of sewer networks are determined by hydraulical, structural and economical issues. Based on the detailed issues the possible steps of the sewer design are the followings: *(Vickridge, 2004)*:

- data acquisition regarding to the design area
- preliminary horizontal alignment
- preliminary vertical alignment
- hydraulical alignment
- geometry of the final alignment
- structural dimensioning

The sewer design steps having key importance in **practical and theoretical point of view** are summarized on **Figure 3**, in case of emerging demands for **new solutions**. In case of a certain design work some designing steps can be dropped out and some new can be inserted, the outlined designing process is valid for a common design work.

Neither the design steps nor its supporting tools **can be always separated** so sharply from each other and not following each other always sequentially. For example the data input and the sewer alignment design can be supported by the same tool, generally with repetitive fill and corrections. The geographical information system is containing the input, storage of data and also the query of the necessary information for decisions. The design process of the decisions supported by the geographical information system can contain feedbacks, loops and successive approximations.
The main target of the computer aided design is to **ease the work of the engineer** by the means of the actual possibilities of the computing technique. It should be kept in mind as a general rule, that the software can only help in the decisions of the engineer, but generally can not substitute it. That’s why should be the role of the engineer highlighted.
Of course not all the engineering activities worth to be computerized. Mostly in case of the repetitive or similar tasks, having much calculation work demand is the main scope of the application of the computing technique.

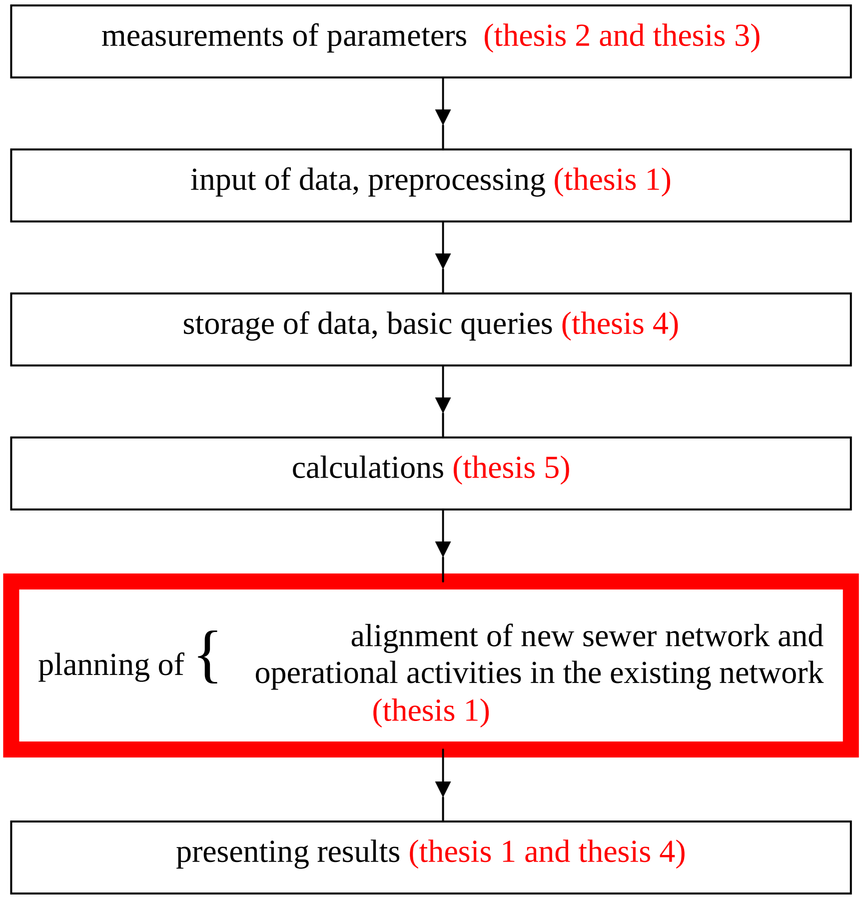


Figure 3 Typical designing steps of sewer design

The theses regarding to the ***designing steps*** *are signed with* ***red character style****.* ***Red frame is*** *highlighting the* ***central*** *step of my dissertation.*

During my research activities I was always dealing with the currently important scopes in the field of the sewer design. In the dissertation those results of my work and research are more detailed, which were determined by me and in the professional content, approach of those work there **are novelties and having importance in practical or theoretical point of view**.

To each step on **Figure 3** a new, important solution was developed:

Regarding to my **1st thesis** I present the developed solution for the **computer aided sewer design**, the principles and novelty of the developed system. The new system can be applied generally on the field of designing of public utilities. The system is supporting the input and processing of data, the optimum spatial design of sewers and the documentation of designing results in precise engineering form. At the time of introduction the presented solution was unique and fundamental, the presented solution is applied successfully countrywide in Hungary at several designing companies.

Regarding to my **2nd and 3rd thesis** I present a solution for the common and basic form of data acquisition necessary for the designing purposes: for the measurements. I present the results from the **analysis of the main parameters of the rainfall monitoring** (spatial density of installation, resolution of the device and time interval for averaging the rainfall intensity). The **self developed rain gauge** is providing data of sufficient quantity and quality for modeling purposes of sewer networks. The practical application of the cost-effective device was proved by several month long rainfall monitoring campaign.

The **4th thesis** is containing the building principles of the developed system for the operation of sewer networks. I was involved in the development as a professional advisor. I present the main features and the novelties of the **asset management system** developed for the sewer network of Budapest, which is essentially necessary for the designing of the operational actions. The storage of the data, execution of basic queries giving spatial and all other necessary information, the modern presentation of results regarding the sewer network can be solved in the GIS system built on the database. The presented solutions were novelties in Hungary and some are still new.

Regarding to the **5th thesis** I present a developed **sediment transport and morphological model** applicable for the calculations of the sediment transported in the sewer network. The model is a part of the developed design-operation system. The sediment transport calculations have been available only by rather expensive, foreign-built, foreign language speaking, commercial sewer simulation software in Hungary until now. The simulation results of the developed SWMM-M sediment transport model are making possible the analysis of the effects of the possible operational actions without the effective execution of them.

Regarding to the **thesis 2 and thesis 5 hydrodynamical modeling** of the sewer network was carried out by the *EPA SWMM5* software *(Rossman, 2010).*

This is about the most worldwide spread program. Because of its **open source** it is possible to incorporate any developed extension. This feature has fundamental importance for the research, because additional development is anticipated on this field. The support of its application and development is quite good (help, manuals, forum etc.). Based on my experiences the application of the software is much simpler as the concurrent ones (*Mike Urban, WinDAP, Kanal++*). Its computational engine is giving similar results as the concurrent commercial and free programs. Several results are presented about the comparison of these programs in the literature.

In case of all compared runoff and flow routing model it can be stated *(Lockie, 2009)*, that the examined software (*SWMM, Mouse/Mike Urban, InfoWorks CS*) are similar in point of view of technical performance, functionalities and reliabilities. Significant differences can be stated regarding only the user interface and data management.

Regarding the hydrological parts (surface runoff, infiltration into ground, interaction with the groundwater) it can be stated *(Lockie and Joseph, 2008)*, that the SWMM is applying more simple models, as the other concurrent programs containing sometimes overcomplicated models (*Mouse, InfoWorks CS*). If there are accessible data for the complex models (e.g. soil parameters, underground surface), then these models can give more precise results. In general for these parameters there are not available sufficient measurements even in the countries which are much richer then Hungary.

The non-linear reservoir model applied as a simplified runoff model of SWMM were giving similar results (*Trommer et al., 1996.*) as the similar commonly used software in the USA, including the model based on the rational method, but only after calibration of the models.

Based on the weighted averages of the evaluation results of technical, economical, applicability and support point of views regarding the 4 compared hydrodynamical models (*InfoWorks, XPSWMM, Mouse, SWMM*) *Mouse* got the highest and *SWMM* got the lowest rank *(Earth Tech Inc., 2006).* The wrong results of *SWMM* was purely because of the computer technical point of views (poor data management, missing of GIS integration and calibration tools, and the complicated automatic labeling of large networks).

The comparison of *SWMM* and *Mouse (Zahidi, 2011)* shows, that the extreme conditions (dry, pressurized, backwater state and long pipes) are solved different ways in the 2 software, because of their different computational methods, but with professional application of them similar results can be reached.

Several application were developed in the world, which eliminated the above-mentioned shortcomings of the SWMM keeping the computational engine for example: *XPSWMM (XP Software, 2011), GeneralStorm (GeneralCom, 2010), WateRisk (Kozma és Koncsos, 2011).*

The *HEC-RAS (Brunner, 2010)* and the *WaterRisk* system 1D hydrodynamical modul, the latter one was built on the *SWMM* engine, approximating several hydraulical situations satisfactory *(Koncsos, 2011).*

Considering the professional literature, model experiences, the available current possibilities the *SWMM* was selected as a modeling tool in the dissertation. Some of the commercial programs could give solutions for the actually emerged problems, but I can see the possibilities of the future development in case of *SWMM*.

Summary of results in theses

The essential elements of the computer aided sewer design were summarized in theses. The determinant element is the ***SewCAD design system*** *contained in thesis 1. The base of the design system are the* ***data management system*** *detailed in thesis 4 and the* ***developments of the hydrodynamical model*** *described in the thesis 5, built on the* ***measurement solutions*** *given in the thesis 2 and thesis 3.*

1st thesis:

Analyzing the engineering-designing thinking I stated that instead of the general engineering designing systems, the – structurally, network, and load – specific system for public works design is more efficient.

I stated, that in general public works design in the two-dimensional plane-sections is most efficient. The computer technically achievable, three-dimensional design can be economical in case of special conditions, primarily because of data acquisition and data input.

I developed the new, detailed method of computer aided public works design, the SewCAD.

Publication of thesis:

(Buzás-Werner-Knolmár, 1991)

(Knolmár-Werner, 1991)

2nd thesis:

The hydrodynamical modeling of sewer networks is elemental part of the modern, computer aided sewer design. The rainfall volume and intensity measurements are essential for the urban drainage design.

I stated the main parameters of the rainfall measurements: spatial density of installation, resolution of the device and time interval for averaging the rainfall intensity). I developed the task-specific calculation method for the analysis of the main parameters.

I demonstrated the necessary limits for the main parameters of the rainfall measurements for the examined subcatchment for modeling purpose. The spatial density in case of the applied 3000m was cost effectively acceptable, unlike the UK code of practice. The results were „very good" in case of 0,2mm tipping bucket size and 20 minutes maximum time interval.

Publication of thesis:

(Knolmár, 2010a)

(Knolmár, 2011b)

3rd thesis

The resolution, density and intensity of measurements defined in the 2nd thesis are necessary for the examined urban drainage network. The developed, innovative raingauge is acceptable in every aspect to the hydrodynamical modeling and operational demands.

The device is based on the most suitable principle for the practical measurements, exploits the most modern electronic and computing technique possibilities.

The advantage of the self-developed raingauge is, that it is recording directly the measured time of tipping in seconds resolution, without any built-in summary or correction method, capable for further development fitting to the actual informatics conditions, and has low application cost.

Publication of thesis:

(Knolmár, 2010a)
(Knolmár, 2011b)

4th thesis

I examined the data types required for operation and design of sewer networks, their possible ways of storage. At the end of the 1980 decade the developed solution was new in Hungary.

I stated that the geographical data of the sewer network should be stored in the general purpose database. It is feasible to store the main part of the sewer network data of the whole organization in a common, general purpose database, because of the consistence and uniform extraction of the data.

I stated that the nowadays worldwide applied GIS extension of the database is not resulting significant increase in the speed of a query related to the well-built general purpose relational (PostgreSQL) database.

Publication of thesis:

(Knolmár-Deli, 1997)
(Knolmár, 2007)
(Knolmár, 2010a)

5th thesis:

I examined sediment transport modules of the hydrodynamical software applicable for computer aided sewer design. For development purpose I selected the software (SWMM) which has no sediment transport extension.

With the new combination of the known relationships for sediment transport, pipe wall friction and bed friction I developed a morphological module fitted to the geometric and hydraulic conditions of the closed sewer section.

The developed module calculates the bed load transport and the morphological change of the bed along the sewer system and in time parallel to the calculation of the hydrodynamical parameters.

I have done the partial sensitivity analysis of the morphological module.

Publication of thesis:
(Knolmár, 2011a)

Summary of Possibilities of Practical Applications

Computer aided sewer design

In 1990 I prepared the first programmatic version of SewCAD, from 2010 I am the professional leader of its development.

In the past 20 years the design method introduced by me became generally accepted. More then 100 companies are change to application of SewCAD, more than 500 pieces licensed the design companies. Network licenses are used in some larger companies. More than 10 thousand km public utilities were built.

Building-up rainfall monitoring network for design and operation purposes

The presented sensitivity analysis method is suitable for the determination of the main parameters of the measurements (e.g. spatial density) in case of a certain subcatchment.

The developed raingauge is with one order cost-effective than the commercial devices. The installation costs are about 100 thousand Ft/ km^2 compared to the commercial raingauges of 1 million Ft/ km^2.

We carried out 2 month long 1 rain monitoring campaign with 17 raingauges (in Sopron), and the devices were working continuously, without problems.

From the general purpose measurements of the Hungarian Meteorological Service (OMSZ) only timeseries of the automatic raingauges are suitable for modeling of sewer networks, but the spatial density of them is not sufficient.

Developing a new GIS for the operation of sewer network

I have determinant role at the development of professional, common database and the GIS applications (CAD-GIS, Browser-GIS) based on this database at the largest Hungarian sewer network service provider company.

Building the sediment model into the designing-operational system

A developed the module calculating the sediment transport fitted to the Hungarian version of SWMM (GeneralStorm), the data input and result display user interface.

The hydrodynamical program extended with the sediment transport (GeneralStorm) is suitable for estimation of morphological processes: the sedimentation in the sewer and the sediment arriving at the wastewater treatment plant.

The demonstrated partial sensitivity analysis gives help to estimation of the accuracy demands of the required data.

More accurate calculation of local losses in the designing-operational system

The calculation of the local losses was built into the selected development purpose software *SWMM.*

The calculation of the local losses provide the possibility for the design of the jumping height at the junction points of the network and for the more accurate design of backwater levels in pipes and for designing the levels at combined sewer overflows.

References

Bozóky-Szeszich, K.: Vízelllátás és csatornázás: Tervezési segédlet, Tankönyvkiadó, Budapest, 1988.

Brunner, G.W.: HEC-RAS River Analysis System, Hydraulic Reference Manual,Version 4.1,US Army Corps of Engineers, Hydrologic Engineering Center, 2011.

Darabos, P. – Mészáros, P.: Közművek, egyetemi jegyzet, Műegyetemi Kiadó, 2006.

Dulovics, D.: Csatorna-hálózatok hidraulikai méretezése, Tervezési segédlet, 1975.

Dulovics, Dné: Közműépítés 3., Csatornázás tervezési segédlet és útmutató, Nemzeti Tankönyvkiadó, 2003.

Earth Tech, Inc: Hydraulic Modelling Software Selection, Technical Memorandum, Concord (US), 2006.

GeneralCom: GeneralStorm, felhasználói programleírás, *2010.*

Horváth, I.: Csatornázás, ÉTK, Budapest, 1985.

Juhász, E.: A csatornázás története, Magyar Víziközmű Szövetség, Budapest, 2008.

Koncsos, L. – Jolánkai, Zs., – Kozma, Zs.: WateRisk integrált vízkészletgazdálkodási modellrendszer egydimenziós hidrodinamikai almodelljének összehasonlító tesztelése a HEC-RAS modellel, Hidrológiai közlöny, 91(4), pp. 50-56, 2011.

Kozma, Zs., – Koncsos, L.: Methodological Overview of a Coupled Water Resources Management Model System, Proceedings of the Thirteenth International Conference on Civil, Structural and Environmental Engineering Computing, B.H.V. Topping and Y. Tsompanakis, (Editors), Civil-Comp Press, Stirlingshire, United Kingdom, paper 157, 2011.

Lockie, T – Joseph, T.: Selection of an appropriate hydrological model to simulate inflow and infiltration, NZWWA Conference, 2008.

Lockie, T.: Catchment modelling using SWMM, Modelling Stream at the 49th Water New Zealand Annual Conference and Expo, 2009.

Öllős, G.: Vízellátás és csatornázás: tervezési segédlet, Tankönyvkiadó, 1983.

Öllős, G.: K + F eredmények, Csatornázás-szennyvíztisztítás I-II., Budapest, AQUA Kiadó 1990.

Rossman, L.A.: Storm Water Management Model, User's Manual, Version 5.0, U.S. Environmental Protection Agency, 2010.

Sali, E.: Csatornázás, Tervezési segédlet, Budapest, Tankönyvkiadó, 1990., Műegyetemi Kiadó 2002.

Trommer, J.T. –Loper, J.E., –Hammett, K.M.: Evaluation and Modification of Five Techniques for Estimating Stormwater Runoff for Watersheds in West-Central Florida, U.S. Geological Survey, Water-Resources Investigations Report 96–4158, 1996.

Vickridge, I.: Aspects of sewer design, In: Sewers: replacement and new construction, pp. 116-131, edited by G.F.Read, Elsevier, 2004.

XP Software: XPSWMM, Reference Manual, 2011.

Zahidi, I.: Comparison between DHI MOUSE and USEPA SWMM5 Computational Engines in Urban Water Modelling, thesis for Master of Science, BME, 2011.

PUBLICATIONS OF MARCELL KNOLMÁR (1991-2011)

Book Section

Saegrov, S. - … - ***Knolmar, M.*** *- ….et al.*: Integrated Urban Water Resources Management, Chapter Wastewater Network Challenges and Solutions, NATO Securities through Science Series, Springer Netherlands, pp. 147-158, 2006.

Foreign Language articles published in Hungary

Werner, J., - Csiti, A., - ***Knolmár, M.:*** Use of Knowledge Based Expert Systems in Water Management of Settlements, Periodica Polytechnica Ser. Civil Eng., Vol.35., Nos. 1-2, general editor:Kollár, I., pp.9-15, 1991.
Knolmár, M., *- Werner, J.* : Computer Aided Sewer Design, Periodica Polytechnica Ser. Civil Eng., Vol.35., Nos. 1-2, general editor:Kollár, I., pp.71-78, 1991.
Somlyódy, L., - ***Knolmár, M.***: Upgrading Wastewater Treatment Plants, Periodica Polytechnica Ser. Civil Eng., Vol.41., No.2, general editor:Kollár, I., pp. 119-134, 1997.

Hungarian Language articles published in Hungary:

Knolmár, M.: Csatornahálózatok hidraulikai modellezése, Hydraulic Modeling of Sewage Systems, Vízmű panoráma XIV.évf.2.szám, pp.8-13., 2006.
Knolmár, M.: Csatornahálózat-modellezés – Lehetőségek és gyakorlati tapasztalatok, Sewer Network Model – Possibilities and Practical Experiences, Vízmű panoráma XV.évf.4.szám , pp.30-34., 2007.
Knolmár, M.: Csapadékmérő fejlesztése, Raingauge development, Hírcsatorna, 2011. – accepted for publication

Foreign langugae lecture in international conference paper:

Knolmar, M. *- Deli, A.*: Hungarian National Database of Water and Wastewater Management, Data Sharing for International Water Resource management: Eastern Europe, Russia and the CIS, NATO ASI Series, 2. Environment – Vol.61., edited by Thomas Naff, Kluwer Academic Publishers, Dordrecht, The Netherlands, 1997., pp. 127-133.

Hungarian langugae lecture in conference paper:

Buzás, K., - Werner, J. - ***Knolmár, M.***: Számítástechnika alkalmazása a szennyvízcsatornázásban, Konferencia kiadvány, Baja, 1991.
Knolmár, M.: Csatornahálózatok hidraulikai modellezése, Konferencia kiadvány, IX. Országos Víziközmű Konferencia, Magyar Víziközmű Szövetség, Sopron, 2005.
Knolmár, M.: Csatornahálózatok számítógéppel segített rehabilitációja (CARE-S), Konferencia kiadvány, ÖkoAqua, Debrecen, 2006.

Knolmár, M.: Csatornahálózat-modellezés – Lehetőségek és gyakorlati tapasztalatok, Konferencia kiadvány, XI. Országos Víziközmű Konferencia, Magyar Víziközmű Szövetség, Sopron, 2007.

Knolmár, M.: Korszerű CAD alapú közműtervező rendszer a hazai gyakorlat számára, Konferencia kiadvány, XIII. Országos Víziközmű Konferencia, Magyar Víziközmű Szövetség, Sopron, 2009.

Knolmár, M.: Csatornahálózat modellezés vízi közműszolgáltatóknál, Konferencia kiadvány, XIV. Országos Víziközmű Konferencia, Magyar Víziközmű Szövetség, Sopron, 2010a.

Knolmár, M.: Csatornahidraulikai szimulációs program fejlesztései, Konferencia kiadvány, XXVIII. Országos Vándorgyűlés, Magyar Hidrológiai Társaság, Sopron, 2010b.

Knolmár, M.: Hordalékszállítás modellezése csatornahálózatokban, Konferencia kiadvány, XV. Országos Víziközmű Konferencia, Magyar Víziközmű Szövetség, Sopron, 2011a