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RESEARCH ARTICLE

# The adaptations of the true-to-form survey method

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#### Abstract

The following study is about the method of surveying historic buildings applied by the Department for History of Architecture and of Monuments of the Budapest University of Technology and Economics. The true-to-form architectural survey is based on the method used in "Bauforschung", the building archaeology practice developed and widely used in Germany. In this context, survey is not only a tool of documentation but is considered as a research method in itself. The authors discuss the importance of the on-the-spot analysis of the building and the role and place of architectural survey in the whole process of monument preservation, as well as the possible adaptation of the method presented under different circumstances. The examples are stages of the monument documentation work carried out on the Cathedral of Saint Michael in Alba Iulia (Gyulafehérvár), Romania.

#### Keywords

true-to-form survey  $\cdot$  building archaeology  $\cdot$  Bauforschung  $\cdot$  Cathedral of Saint Michael in Alba Iulia

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Department for History of Architecture and of Monuments, BME, H-1111 Budapest, Műegyetem K. 260., Hungary e-mail: mkata@et.bme.hu webpage: www.eptort.bme.hu Our actual study presents the possibilities of applying the true-to-form architectural survey as a monument research method based on the experiences of work recently carried out on the Cathedral of Saint Michael in Alba Iulia (Gyulafehérvár), Romania by the Department for History of Architecture and of Monuments of the Budapest University of Technology and Economics.



**Fig. 1.** Saint Michael's Cathedral in Alba Iulia South-western tower east facade 5th level (hand measurement, detail)

In accordance with our conviction, historical buildings research cannot be the scene of rivalry among the professions of archaeology, art history and architecture; the discourse on the methods also has to rise above the desire for the exclusiveness of procedures applied in certain workshops. In one respect, the aim of our study is to present the work carried out in our research centre. Our open intention is to arouse interest towards the widespread application of the method and to inspire the experts of the subject to work on further development, perfecting it and also on its adaptation to other scenes and tasks of the procedure. Last but not least we would like to dispel the misconceptions appearing repeatedly in recent Hungarian scientific literature in connection with the concept and application of the "true-to-form architectural survey" and the "Bauforschung". Therefore, first of all, it is necessary to define these two concepts often appearing next to, furthermore, sometimes merging into each other. This is not to generate a debate around technical terms, but in order to make it clear what we exactly mean when using these phrases below.

By the word "Bauforschung" [1, 2, 5, 8, 10, 16] we mean a complex building research process which includes the archival research, the critical analysis of the scientific literature and the reflections of style criticism, as well as the restoration and archaeological explorations in which the architects, art historians and archaeologists equally find their own fields of duties. However, it is of key importance that the primary source is always the building itself; all the features and characteristics found on the building since the aim of the research is the explanation of the phenomena observed in the existing state of the building. The architectural concept aimed at the maintenance, renovation or reconstruction of the building can be best elaborated with the most perfect knowledge of this, and is the final objective of the protection of historic buildings. The other cornerstone of our Bauforschung concept is to reduce damaging interventions to the necessary minimum. Nevertheless, the invasive explorations do not have to and cannot be disregarded; it is very important to make them happen after appropriate preparation and only in a targeted way, in the required place and to the extent necessary.

Therefore Bauforschung, although in a different order and with a different emphasis, essentially applies similar methods like other building research trends. Yet, the role and method of the building survey make a definite distinction between them. Since the primary source of the research is the building itself and prior to any theoretical considerations or practical interventions, as the first step of the research, the most accurate documentation possible of the existing state is needed. The most appropriate survey method for Bauforschung is called true-toform architectural survey. The essence of this method which basically originates from the graphical documentation method of archaeological excavations, is to record the measured data of the building in comparison with an absolute geometric net - system of co-ordinates, which is independent of the object. By this means it is free from the supposition of any geometric regularities like perpendicularity, parallelism, rectangularity and the size congruence between elements seeming to be the same. However, the method we call true-to-form survey has two more important criteria. One is that the survey drawing is basically prepared on the spot, in this way each phenomenon can be recorded during drawing on the basis of direct observation by the means of drawing and textual comments. The other aspect is that in this case the survey drawing is prepared by the researcher or at least by the drawer working under the on-the-spot supervision of the researcher and having architectural qualifications as well. So the true-to-form architectural survey is not a simple documentation process but one of the most important research methods of the Bauforschung.

Some experts who otherwise acknowledge the importance of the survey also refuse to accept this statement. We have tried to demonstrate our conviction by the analogy of a method used in other fields of architecture, mainly in urban studies; the Geographical Information System (GIS) that is widely applied in the field of geoinformatics. The essence of the method is the integration of spatial and descriptive information into one system, i.e. the connection of all the data important for the researcher to the spot the data refer to in a visual depiction (in case of GIS on a map). On the one hand, it provides opportunity for the classification of data, on the other hand, it makes it possible to review and recognize the spatial relations of the features. The building survey method recording all the features relevant in respect of the technology and history of architecture, graphically and in the form of textual comments in a survey drawing works according to the same principle. In case of GIS the connection of data is usually done at a later date with the help of significant computer technology. It certainly would be possible in the case of traditional monument research, if the data of the description made by the researcher were also made quickly and clearly identifiable on the survey drawing, however according to practice, often exactly this time-consuming follow-up work does not occur, although this would make the result of the research easily manageable for other users later. On the contrary, usually the reality is that the analysis of the documentation made during the previous research needs a similar amount of time invested as if the features were observed on the building itself. Owing to this inevitable and of course not intentionally negative view, the completed research report and the summary of the scientific results are usually considered, by the researcher handling the data, as the aim of his work. In other words: in most building research documentation we can find the illustrative (either graphical or photographic) presentation of those phenomena which confirm the researcher's final conclusions. The invaluable mass of facts the researcher has waded through himself are kept on notebook pages, compact disks lying at the bottom of drawers, dictaphone recordings or in a less fortunate case, only in the researcher's memory. They may get to a publicly researchable location as legacies only after decades.

According to our opinion, the summarizing of the results is only a part of the researcher's job. He can make his work useful and authentic, if he completely documents and publishes not only his own conclusions but also the objective data they are based on; everything he has seen and experienced before he would have drawn conclusions from them. So at the same time he provides the basis for the criticism of his own conclusions. This kind of documentation is extremely important in those cases when the researcher carries out his work prior to the physical destruction of the building or before it becomes inaccessible. Although, in most cases historical building research is like that – whether because of renovation, reconstruction, the filling and rough-casting of excavated parts, the demolition or unavoidable destruction of the building. In our case the survey does not just illustrate the research but it also records the state previous to it, even in a way that it could also have documentary value for later research. The true-to-form architectural survey is the most appropriate tool for achieving the objectives mentioned above.

### The true-to-form survey and the modern building survey techniques

The most important comment we have to make in connection with the comparison of our analytical survey method and other modern survey techniques is that the true-to-form survey is not a technical innovation. As it can be seen from the description of our works presented below, the method can be applied by the wide use of the most modern technical devices just as without them; there will not be a difference in the accuracy or in the scientific content available in the final outcome. The application of modern instruments only makes a difference regarding the time, cost and the size of the necessary labour force.

Similar to the true-to-form survey, some modern building survey processes result in a spectacular, accurate and detailed documentation. The photogrammetry holds out promises of representing the object identical with the picture visible to our eyes, furthermore, in a perfectly accurate, scalable orthogonal depiction providing measurable data. However, this is only true in case of a perfectly flat surface, each shift of levels, protruding part or surface roughness significantly increases the number of necessary pictures and the time to be spent with data processing. It seems to be a fast procedure but in practice it can be very time-consuming. Actually, it cannot be applied in case of a scaffolded or plant-covered part of a building. Moreover, often it is very difficult to detect a difference between certain materials on the photographs, even between mortar and a stone surface having an identical colour; shadows and contaminations can also be disturbing and deceptive. Therefore, in the same way, the thorough local survey of the surface is necessary in order to achieve a precise drawing.

3D laser scanners provide accurate information about the spatial location of each measured object and provide the opportunity for an extremely fast on-the-spot survey. Yet, the result is a point-cloud in which each point has to be interpreted at a later date during the processing in order to make the lines, edges and planes definable. So the logic is the reverse of the one in case of traditional surveys where first an object is identified then the relating sizes are recorded. However, there is value in the precise method if the survey itself does not give any additional information besides the fact that the laser ray has met with an obstacle, as a result of which the appropriate evaluation of the data needs further onsite surveys.

Of course there is no question about the usefulness of these tools in the course of surveying monument buildings. They can be excellently integrated into the true-to-form survey method in order to carry out certain sub-tasks if the financial and material conditions are provided. For instance, photogrammetry can be very effectively applied for inserting the remains of wall pictures into a front elevation drawing; the dimensional scanner is also an invaluable help for defining the spatial relations of buildings or surveying not easily accessible high points, for example a steeple, or mapping the geometry of complex forms like an irregularly shaped cellar or a net vault. Nevertheless, these opportunities provided by technical devices should not be overestimated and it is a mistake to believe that the process of the explanatory drawing method can be replaced by them, as only a well-qualified expert is able to do this.

In our opinion the ideal working process for research into the history of architecture, in terms of research and planning, is the following: In the first step, a true-to-form architectural survey is prepared about the existing state of the building without any interference, except for the cleaning of any contamination hindering the survey of the particulars. This means, for example, that the thick layer of dust settled in the nooks of a footing profile is removed but the whitewashing and rough-casting carried up on the cornices in several layers over a period of years are not. Then the result of this survey is subjected to a thorough analysis. Parallel with the survey, the archival, plan collection and scientific literature data are also collected including archive photographs and any depictions. This is the phase of work when the researcher collects objective data; and the documentation of this stage before any further interventions is considered very important. The second phase is the evaluation and analysis of these results. First of all, special attention has to be paid to the geometric and structural anomalies indicated on the survey drawing, and the features observed on-the-spot have to be compared with the data of the written and visual sources. Following this, in the third phase of the research, the restorer's explorations and archaeological excavations, including the application of the tool of the traditional invasive wall structure analysis are carried out. Here, there is already an opportunity to make an intervention focusing on the reply of the given questions. In any case, the results of the excavations need to be documented in the same way and scale as it was done during the original survey; of course the point is not to make a complete survey again but to record the excavated particulars on a new layer. The system of co-ordinates previously set for the true-to-form survey provides an opportunity to position them precisely. This process probably can be realized in several steps since drawing together the excavated particulars can throw light upon such relations which can raise new questions and result in further excavations. As a result of this, the history, periodization and the so called value cadastre of the building is elaborated. In the establishment of the latter in the case of renovation or reconstruction – the involvement of a designer architect is unavoidable since most monuments are mainly living buildings, their value is not only influenced by their antiquity and historical value but by their value of use as well. It is very important to add that the researcher's work at this point is not yet finished. That is, in the course of restoration and reconstruction some demolitions - permitted due to the previous

results – inevitably become actual owing to which, as the structure can be seen, further information useful for the researcher can be gained and the documentation of this should be prepared with similar thoroughness.

Of course, the process mentioned above is time-consuming and expensive. There is precious little chance of realizing it in case of each and every monument – or at least in case of those having significant historical value. Therefore it has to be regarded not as a rigid canon but as a theoretical establishment in the spirit of which we have to stick by an adaptation harmonized with the circumstances of a given task.

In relation to the research and survey of the built heritage we meet a great variety of tasks in respect of the aim and also the possibilities: from the value preserving-documenting survey of a crumbling cottage before demolition or destruction to the preparation of the vast restoration works of historical values determining the identity of a nation. Therefore the methods of the survey and research cannot be the same; arguing for the elaboration of a procedure which can be applied in each and every situation is basically a wrong approach to begin with.

The survey of the building of the former general headquarters of national defence (on Szent György square in Budapest's castle district) was the first Bauforschung work of the Department for History of Architecture and of Monuments of the Budapest University of Technology and Economics in 1999<sup>1</sup>. During the following years there were only a few possibilities to apply the method and to some extent these were such reference works which have been initiated by the Department or its researchers and financed by own resources or with the support of the Hungarian Scientific Research Fund [7]. This includes the survey of the churches of Dabrony, Maglód and Pilis within the framework of Dr. János Krähling's programme to survey Hungarian Lutheran churches and also Balázs Halmos's research on the Lázói Chapel in Gyulafehérvár. A more considerable external assignment had to wait until 2003 when the National Trust of Monuments for Hungary charged our Department with the research of the building of the former puppet theatre and orange house of the Esterházy Castle in Fertőd, the task of which was definitely a trial of the Bauforschung. At the same time, due to our partners, the archaeologists of the Field Service for Cultural Heritage, András Koppány and László Thúry, the task also provided an opportunity for implementing an excellent cooperation of the professions of architecture and archaeology in the field of building research.

The Department started working on the following project in 2008 when – according to the favourable experiences of the survey and research of the Lázói Chapel – we addressed ourselves to the several year task of surveying the Cathedral of Saint Michael in Alba Iulia.

#### The surveys carried out in Alba Iulia (Gyulafehérvár) by the Department for History of Architecture and of Monuments of the Budapest University of Technology and Economics in 2008-2010

The Cathedral of Saint Michael in Gyulafehérvár, which according to István Möller's definition "as a historical and artistic monument, it stands in first place among our churches" [12, p. 16] needed renovation during its eventful history<sup>2</sup> several times. We can talk about expert monument restoration from the end of the 19<sup>th</sup> century. The work was based on the survey directed by the Budapest university professor Imre Steindl, then the renovation conducted by István Möller defined the direction of the current research and restorations.<sup>3</sup> Möller's renovation was interrupted by the outbreak of the First World War; only minor corrections were carried out on the basis of Möller's principled guidance by Sándor Fridli between the two wars. After the Second World War the work was suspended for a long time, eventually being continued under the direction of Lajos Bágyuj between 1967 and 1973. In parallel with this, extensive excavations were carried out by Radu Heitel in the cathedral and in its surroundings between 1967 and 1968. The restoration was continued by Hermann Fabini in the 1990s. These renovation works were not followed by a wide range of documenting and research activities<sup>4</sup> and the interventions focused only on the solving of certain tasks and urgent corrections.

The opportunity for a complete renovation carried out on the basis of a comprehensive concept and having been necessary for a long time occurred only at the very end of the 20<sup>th</sup> century. At this time the National Board for Protection of Historic Monuments worked out a ten-year plan for the renovation of the cathedral conducted by Gyula Káldi and Márton Sarkadi – timed to the millennium of the existence of the episcopacy.<sup>5</sup> Parallel with this, archaeologist Daniela Marcu carried out further excavations.<sup>6</sup> The works started in 1999 but unfortunately they were soon interrupted.

The renovation of the cathedral was given renewed momentum by the impending millennial existence of the episcopacy. The restoration of the Lázói chapel and the southern tower being the most important element of the main front was completed in 2009. At the beginning of this latter work, in 2008, the Department for History of Architecture and of Monuments of Budapest University of Technology and Economics was charged with making a true-to-form survey of the upper four storeys of the tower by the Roman Catholic Archbishopric in Alba Iulia.

<sup>&</sup>lt;sup>1</sup> The work was implemented with the participation of Dr. Miklós Kalmár, Dr. János Krähling, László Daragó and Ferenc Sebestény.

<sup>&</sup>lt;sup>2</sup> The history of the cathedral has been comprehensively summarized by Géza Entz, the research history has been presented in detail by Márton Sarkadi. [3, 14]

<sup>&</sup>lt;sup>3</sup> About István Möller's interventions in detail: Sarkadi 2010, Halmos-Marótzy 2010

<sup>&</sup>lt;sup>4</sup> Radu Heitel's excavation documentation is available at the Plan Collection of the National Office of Cultural Heritage.

<sup>&</sup>lt;sup>5</sup> The experiences of the ten-year-planned programme: Káldi – Sarkadi 2002, Sarkadi 2003

<sup>&</sup>lt;sup>6</sup> The summary of a part of the results: Marcu 2008

The survey presents the state previous to the intervention, complemented with the documentation of the results of minor explorations carried out by the restorer working at the same time. We were charged with the survey of the second section (lower part) after the completion of the restorer's work, in the early spring of 2009, by the National Office of Cultural Heritage, therefore this documentation already presents the post-restoration state. The successful cooperation between the three parties: the Hungarian National Office of Cultural Heritage, the Roman Catholic Archbishopric in Alba Iulia and the Department for History of Architecture and of Monuments of the Budapest University of Technology and Economics, was also continued after the millenary events. Before the planned renovation of the so called Gothic chancel being in a bad technical condition, in the summer of 2009 and 2010, we had the chance to make a true-to-form survey outside and as well inside.

The conducted four surveys took the same approach, however regarding their implementation and results, due to the different opportunities and conditions, they are significantly different.

In each case, the first step of the method on site was the setting of the vertical and horizontal axis. The simplest tools were utilised for this initial work, that of the plummet and hose water level. In case of the tower and the external frontages of the chancel this was checked with a rotary laser level. However, the use of this modern tool was limited due to the covering of the scaffold built in front of the facade. The choice of the axis location occurred mainly due to practical viewpoints, conforming to the levels of the scaffold and to the geometry of the building in the interest of an easier, more comfortable and safer measurement. In case of the building elements protruding from or recessing in the frontage, for instance cornices or the frames of openings, it was necessary to divide the axis into smaller segments in order to precisely use the spirit-levels used during the measurements; in the case of the surveys made in Alba Iulia the level of precision was 0.5 cm. The axial distances, since they have to conform to the circumstances on-the-spot, are usually not round figures therefore special attention has been paid to the precise documentation of the measuring system. On the basis of this the net can be re-established at any time when it is needed.

The marking cords were fixed on the external facades with the help of nails put into the wall joints; inside the chancel where mainly plastered surfaces were found, we used screws which have been put into the boreholes.

In each case our task was to survey the frontage and record the surface features of the facades. The applied method was two-dimensional, that is each and every frontage including the separate front surfaces of the buttresses, has been defined as an individual plane. The documentation provides only limited information about the position of the frontal planes compared to each other, the possible deformations and their spatial geometry; the surveys can only be interpreted by taking this deficiency into consideration.

The version of the method preferred in a given situation de-



**Fig. 2.** Saint Michael's Cathedral in Alba Iulia south-western tower east facade 5th level (CAD documentation, detail)

287	-82	-41,5	- 41	-825			×	2
	+955	+95	+625	+615			1 2 1	
288	-395	+215	+225	-395			1-12	kalapoisnyo.
	+97	+98	+63	+62			4 4 3	S moran mess
289	+32	+47	+51	+515	+235	+23	1 - 2 overep	nosar
	+97	+ 975	+95	+63	+625	+93	s i	mac Wolf
290	+535	+835	+835	+535			1 2	
	+97	+975	+625	+615			4 3	1
291	+845	+114	+1145	+109	+84		1-2	
	+97	+ 98	+655	+615	+62		3	1
292	+/15	+1445	+1445	+1155			1 2	and all all
	+965	+ 98	+635	+63			1 La	
293	+147	- 445	- 44	+1505	+1465		1 2	Schuleber
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294	-44	-23	-23	-265	-76	-73	100012	VC.
	-102	-1025	-/38	-1345	-1375	-108	1 4 8 3	manna

Fig. 3. Saint Michael's Cathedral in Alba Iulia "Steinbuch" (detail)



**Fig. 4.** Saint Michael's Cathedral in Alba Iulia south-western tower west facade 2nd level (CAD documentation, detail)

pended on the formal and surface features of the object, number and skills of the colleagues, time and equipment available and on the environmental circumstances. However, even after careful preparation and consideration, unexpected circumstances arose and architectural features which could not be mapped earlier meant that we had to adjust the programme during our work.



**Fig. 5.** Saint Michael's Cathedral in Alba Iulia Gothic chancel south facade, external 3rd section (hand measurement, detail)

### The survey of the upper four storeys of the southern tower – July 2008

In case of the upper storeys of the tower the work was done according to the method applied by the Department earlier which is the processing carried out parallel with the measuring.<sup>7</sup> The measured data was recorded on separate segments on a scale of 1:20, constructed in pencil by those participating in the survey, and with the help of which the surface parts were depicted in a proper dimension. In each case, all corner points of every stone element have been recorded by precise measurement. Thus the survey reveals the derivation of the wall joints from horizontal and vertical, their exact thickness and its change. Besides the stone damage: clefts crumbling; mechanical damage and the visible marks of stone dressing tools including mason's marks and corrections; brick, tile, iron and wood elements were separately indicated. Replacements, wedges and wall-ties were also indicated on the drawings. The work carried out during the day was completed by the observations after dark when the documentation of the details visible only in a grazing light with the help of a torch (mainly the fainter mason's marks) was also carried out.

The front drawings of the upper part have been elaborated

by scanning and putting together the prepared drawings. At the client's request, a vectorized digital version has also been prepared of these with ArchiCAD software, redrawn line by line.

The disadvantage of the method is that the drawing of a segment needs two colleagues, one measuring, the other one drawing; this with real time calculations of the scale also slows down the work. The post-documentation that is the redrawing of the drawings is also very time-consuming and labour intensive, however the finished drawings are of great precision; the extensive time spent in front of a given building surface resulted in a precise and detailed observation. This emphasized the greatest advantage of the building survey of the "Bauforschung" approach, the on-the-spot thinking through observing method, the human factor.

### The survey of the lower storeys of the southern tower – March-April 2010

A solution different from the one mentioned above has been applied during the survey of the lower part. Since the on-thespot work had to be minimized because of the unfavourable weather conditions, a tabular survey report (we used the term "Steinbuch") recording the measured data has been introduced. The aim of the table is to allow the preparation of such a detailed drawing in the course of the post-processing which faithfully depicts the facades by the simultaneous use of the data recorded in the table and the photos made during the survey. Each stone is presented in a different row of the table by the indication of the horizontal and vertical coordinates of the necessary number (generally 6-10) of their corner points. The ashlars on the walling of mediaeval origin hardly ever remained in a perfect state of preservation, in many cases their edges are broken and their corners are chipped. Therefore, at this time the measured "corner points" are principal points which mean the intersections of the idealized lines of the affected side edges. This makes the precise positioning of the elements easier to a great extent in the course of processing. In the interest of the appropriate identification of the stone and the measured point, a sketch plan belongs to each stone included in the table. The measured points usually follow each other in a clockwise sequence starting from the right upper corner point. In case of a different order the sketch plan gives information on the numbering. Other features referring to the stone surface such as clefts, damage, lifting holes and stone dressing marks have also been indicated on the sketch plan; if necessary also including their important dimensions. Therefore, during the recording of data the surface has been examined with the same thoroughness and exhaustiveness just as in the case of the traditional true-to-form survey constructed on-the-spot, however the time necessary for the on-the-spot drawing was shorter.

The post-processing of the lower part of the tower has been carried out with ArchiCAD software. In a phase of the construction we had the chance to check the drawings in progress on-the-spot and to correct certain measurement deficiencies. In

<sup>&</sup>lt;sup>7</sup> Krähling – Fekete – Halmos 2006

our opinion we cannot disregard this checking in the case of this kind of survey.

Compared to the survey of the upper part, the completed digital, vectoral drawing is graphically less true to nature, it contains more simplifications regarding the details, for example precise tracing of clefts, accurate contouring of fractures and chips. However these do not have an influence on the technical content relevant in respect of architecture and history of art. The drawing indicates the surface features such as material quality, dressing etc., in the forms of different fill patterns and by providing the necessary key to aid understanding.

## The external survey of the so called Gothic chancel – July 2009

Analysing the evidence from the previous measurements, a combined method has been applied for the external survey of the chancel. The first step, the geometry of the stones has been recorded by the "Steinbuch system" survey with the help of coordinates. This has been constructed as a cross hatching onthe-spot with the application of the ArchiCAD software by the colleagues. The possible inaccuracies, typically the confusion of the signs of the coordinates could be corrected immediately. The construction has been printed out to a scale of 1:20; similar to the tower; the details and material characteristics have been graphically recorded on these segments by hand. In the case of the chancel, the key has been established according to the features of the scene, taking care to make the signs and fill patterns different and easily drawable. Colourful, light dashed-pointed lines have been applied to the printed cross hatching therefore the digital pre-construction is distinctly visible for the drawer, however in the final state these are if the construction is precise, basically covered by the drawing. The documentation has been created by assembling the segments drawn by hand.

## The internal survey of the so called Gothic chancel – July 2010

Contrary to the previous experiences, extensive plastered surfaces have been found inside the chancel, the measurement applied in the case of the external part had to be modified. Instead of stones interpretable as closed cross hatchings, the corner points at the sometimes one centimetre thick wall joints carved into the coat of plaster, not the boundaries of the stony surfaces have been measured. The computer construction and the on-the-spot drawing have been completed as had been done before, however in this present case for the key, the recording of the different surfacings e.g. levelling and smoothing mortar, whitewashing, painting not the recording of the stones had to be taken into consideration. The segmental plane processing has been completed with part measurements carried out with the help of traditional manual methods. Besides the assembly of the drawn segments, the preparation of a vectorized, digital drawing has also been carried out in the course of the documentation, using and elaborating further the basic construction made on-







**Fig. 7.** Saint Michael's Cathedral in Alba Iulia Gothic chancel south elevation, internal 9th section (CAD documentation, detail)

the-spot.

In all four cases a stone-by-stone photo documentation was annexed which does not substitute for the tactile observation, it helps to avoid mistakes at the preparation of the final documentation which is often done by a person other than the one who drew the given segment. The surveys except for the one carried out in the spring of 2009, have been conducted by involving university students of architecture. The participation of the students provides a special opportunity to teach them personally which is unimaginable in the framework of mass education, although it requires great attention and continuous control on behalf of the leaders of the survey. In any case, at the local adaptation of the method, the education and the experience of colleagues regardless their school qualifications, have to be taken into consideration. In our case the students' task was only to draw the surfaces with great accuracy and to indicate specifically the change of materials. However due to the lack of appropriate experience, the identification of all the different materials could not be their task, furthermore, at the beginning of the drawing while establishing the key, we did not know for example how many different types of mortar would occur on the facades. Therefore in this respect, only two types have been distinguished on the drawings: the smoothed surfacing plaster and other mortar. The identification of the materials of different combinations which are probably of different ages, is already the researcher's task; this can be marked by colours quickly and simply on the prepared drawings.

### The place of the true-to-form survey in the process of monument renovation – our experiences

The visual data observed and recorded during the surveys show formal, material and surface characteristics. These refer to the building technology, to the historic characteristics of the construction and to the technical condition. Structural description and relative dating can be elaborated by its primary analysis. Consequent to this, the place of the true-to-form survey as a research method in monument renovation is of basic research character, it has to be conducted in the same phase and complement the historic research (library, archival, plan and photo collection). The on-the-spot observations can raise such questions which may call the researcher's attention to the study of previously disregarded topics, and the questions left open by the historical research can be brought into focus during the on-thespot work. We are convinced that the invasive interventions can be planned and carried out more effectively and the unnecessary destruction can be avoided with the help of the completed documentation. The different phases, even including only parts of the research can be indicated in the survey documentation presenting the whole part of the building in order to help the systematization of the information. Subsequent to the thorough research, the planning and the post-documentation of the interventions in monuments can be recorded in a unified system with the help of the digital documentation of the survey.

The application of the ideal process of work mentioned above is made more difficult by the fact that the basic condition of the survey is the existence of the scaffold which is needed for long periods but only in certain phases until the beginning of the restoration. The process of the research-analysis, which often cannot be planned exactly, and on-the-spot surveys alternating with each other needs several building seasons which is usually an inconveniently long time for the client. In the case when the investor is in possession of the completed renovation plan, he has several opportunities to procure the necessary financial resources; all this is much more difficult in the research phase. On the other hand however, the true-to-form survey needs a scaffold although its costs are much lower than those of modern instrumental measurements. The advantages and disadvantages of the true-to-form survey have to be seriously considered before its commencement. In the case when the surface of the object to be restored is homogeneous, for example plastered in the same way, and there is no opportunity for scaffolding before the beginning of the restoration, the application of photogrammetric and dimensional scanner measurements could be more effective. However, in cases when invasive interventions are carried out which include the possibility of destroying the valuable historic layers or the surface characteristics have to be interpreted - for instance because the plastered and stone surfaces have similar porous pictures - that is, when the true-to-form survey represents significant added value; the choice of the explanatory observation method is needed.

Our partners cooperating during the works carried out in Alba Iulia – the Hungarian National Office of Cultural Heritage and the Roman Catholic Archbishopric in Alba Iulia – kept in mind the above mentioned viewpoints. In the case of the survey of the upper storeys of the southern tower, we worked parallel to the restoration and there was an opportunity to record the historical status. Regarding the lower storeys of the tower, the survey has been conducted subsequently to the actions carried out, unfortunately only the state after renovation could be documented. In case of the external part of the chancel the surveys have been carried out before the invasive interventions, while regarding its internal part they have been conducted after the wall research but before the beginning of the renovation, therefore this part of the building could be documented as it was left to us by history.

An essential role is played by recording the state previous to the present interventions during the researches of history of art and architecture, in the process of becoming acquainted with our national history. In the lack of thorough documentation and by the erudition of the structures, making distinctions between the characteristics of the original construction and those developed in consequence of the later interventions becomes more and more difficult over the course of time; damage to the historical authenticity of the building can easily arise. In the history of the Cathedral in Alba Iulia, István Möller's interventions and their exemplary documentation provide evidence for the importance of thorough pre-documentation, since the researchers have been using these drawings prepared at the beginning of the  $20^{th}$ century up to this day even though they are trying to reveal the medieval building history of the Cathedral.

Summarising the scientific results provided by the research work carried out in Alba Iulia over the last two years: In case of the southern tower the most beneficial outcome was refining the relative chronology of the upper storeys and identifying several different phases of construction in surfaces previously considered to be results of one single working process. Differences discovered in technical mode and quality of construction revealed possible changes of workshops active in the 14<sup>th</sup> and 15<sup>th</sup> century, as well as several alterations of the plan while constructing the tower or reconstructive interventions in structures erected earlier. In case of the Gothic Chancel, recent research of a collective of architects, restorers and art historians<sup>8</sup> revised the formerly accepted building history by verifying that the chancel was demolished and rebuilt in the middle of the  $18^{th}$  century. Our research based on true-to-form survey contributed to this co-operation with several data on the technical details of this reconstruction with several questions answered and others raised on the original gothic look of the chancel. A detailed report of these results will be published by the authors of the present study in the near future.

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<sup>&</sup>lt;sup>8</sup> Art historian Szilárd Papp from the Budapest Museum of Fine Arts, restorers Hunor Egri and Loránd Kiss, and architect Arnold Macalik.