ARCHITECTURAL SURVEY IN PRACTICE

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Abstract:

The technological developments have led to attractive results as well as improvements in economic efficiency of architectural surveys. It is commonly believed that the acceptance of, therefore inquiries for, surveys of monuments and buildings has increased. The demand mainly comes from the sector of renovation planning and restoration. At the same time many new tenderers for such services have entered into the market.

This presentation comments on the issues concerning this specific market. Under the terms of this market the price of the service plays a crucial role. However, on a regular basis an adequate definition of the contents of the renovation and restoration plans are missing. Generally the remarks or notes are not precise enough and do not take into account the specific requirements of each object. In the end missing or non-verifiable quality criterions, as well as the lack of experience of untrained providers, is responsible for these deficiencies. To some extent unuseable results will lead to much increased time and expenditure than was planned in the beginning by opting for the low-priced offerings in an attempt to save money.

From decades worth of experience several typical projects are chosen and presented. With these projects the context of the specific requirements of the different concepts of survey being used are to be shown. For the quality of the results of a architectural survey various technological framework requirements need to be provided. The economical efficiency of a architectural survey ultimately determines the benefit that results from the renovation planning. Deficiencies on the opposite will lead to cost increases and delays.

The current training of survey engineers scarcely considers the specific requirements of a professional architectural survey. This requires an in-depth understanding of the architectural, architectural forms and interior elements of building architectural, and historical building architectural in particular.

These need to be investigated, analyzed, surveyed, drawn and presented with respect to the utility in descriptive and comprehensive As-Built-Plans. However, precise content and project-specific requirements on the part of the architects are unfortunately rather seldom. This consistently results in new challenges in the discussion between both parties.

1. CURRENT SITUATION

In order to understand the current problems in the dispute between clients and providers, we first have to look back at the developments of the last 20 years. The dispute between the contract parties has both a technical and a profane economic side.

The introduction of computers in the field of architectural surveying in the 90s led to a revolution in the practice of architectural surveys. Until then relatively few architectural surveys were performed compared with today. Of course, they were performed with standard manual methods. Measurements were made from point to point using time-consuming methods with preconfigured string systems. Even fewer photogrammetric surveys were performed. While the former were largely implemented by trained architects or architectural historians, photogrammetry was the preserve of geodesic experts due to the technical conditions. In both cases, this work was performed by experienced employees with many years of practical work. Tachymetric architectural surveys and simple photogrammetric systems increased productivity significantly. Today, everything is much faster, which means that the acquisition costs of hardware and software no longer plays a key role. If used enough, amortisation of the system costs is a fraction of the personnel costs. This has two kinds of consequences.

Prices have dropped enormously, which increased the number of architectural surveys performed. That is a good thing. Just 10 years ago, older employees in construction authorities who are wary of performing supposedly expensive surveys from their earlier experience. Today, every client can afford one, provided they or their architect is aware of the benefit of an architectural survey. On the other hand, this does not mean that it is naturally always done this way.

The other side of the coin is that anyone with this technology can provide architectural surveys. For example, a surveying firm was commissioned to architecturally survey a precious historic building. The firm has 10 employees who specialise in border surveying, rail surveying, road surveying, site mapping and surveying during construction work. The result of this case is as yet unknown, but there are unfortunately many other cases which resulted in economic damages. And even if this was just a repeated survey. It is typical of how a survey of a castle is demanded. Only companies which can provide 22 floor plans, sections and elevations for multiple winding parts of buildings including the roof structures for an equivalent of less then 20 working days have a chance to win the job. The only requirement made was "it has to be accurate". This lamentable side of the market development is counteracted by more positive experience. Seldom, but more and more frequently, in-depth calls to tender are being issued, probably as a result of these problems. Competition can only be considered fair if the service expected is defined precisely. Clients can only be sure of their investment if the acceptance criteria are precise.

The examples below will demonstrate why not only the final result must be defined but also the way to reach it must also be considered with their technical conditions.

2. ARCHITECTURAL SURVEYS AS A LEARNING PROCESS OR THE PORTRAYAL OF ARCHITECTUR

Please forgive me for not going into sufficient detail on the excellent work and presentation of historic architectural surveys here. For more detail, see the conference proceedings "From manual surveying to high-tech III – 3D in historic architectural surveying" [1]. The projects presented there show the benefits of 3D visualisation - for example a 4D visualisation including the chronological sequence as an increase in valuable knowledge for the historic development and changes to a building.

However, the day-to-day practice regularly demands two-dimensional maps of existing building remains. That would appear contradictory to the standard three-dimensional measurement methods. They are generally commissioned for renovation and restoration projects. The parties involved are accustomed to read the spatial and construction context of the building and the historic and fitting features from layout plans, sections, elevations and projections. Compared with 3D models, exchanging data in 2D is more practical and easier to bring to the construction site. The results of an architectural survey form the basis for the documentation of further studies (damage mapping); they are the basis for planning and are used for precise calculations of quantities for invitations to tender.

Let us first consider depictions of architecture – in this case real pictures. For the purposes of architectural surveys, this refers of course to scale orthophotos, drawings or simple rectified mapping photographs, or equally to all results of 3D scans. Of course, photographs also make statements, depending on the aspect for which they were made, as photography always assumes a goal. In spite of this, a distinction must be made. Images are only the basis for further evaluation and analyses, not the result of an interpretation. As the creation of these products is not simple in most cases, specialists with the photogrammetric and geodesic expertise and the necessary technology are required. The abovementioned evaluation and interpretation are performed by other specialists – this is a clearly defined division of labour.
One orthophoto of a ceiling elevation with rich stucco ornamentation and haunches will serve as an example of the possibilities of photogrammetry and its competitiveness with 3D scans.

Figure 1: Bamberg – New Residence Palace, original scale 1:10

Pixels in images and 3D points in a point-cloud are just as good or bad as the imaging disposition of the camera or the scanner to the façade. Neither cases permit angled imaging positions. This is not just because of views from below and masking, but also because of enormously worsened resolution or point density on the surface. Thus, a primarily frontal imaging position is an easy to verify requirement for good quality results. Imaging planning should be requested when calling for quotations.
This is where photogrammetry can reveal its special advantages when documenting high facades. Working platforms of various sizes are regularly used when taking mapping images.

Figure 2: Use of an 83m working platform at the Church of Our Lady in Munich

A recent article on Bremen Cathedral demonstrates that this procedure makes technical and economic sense for preparing renovation projects [2]. If a working platform cannot be used, helicopters are an alternative option. If a corresponding resource planning taking lighting conditions into consideration is put in place, this option is often the only solution. It is also extremely economical. This is also confirmed compared with model helicopters. They should only be used if no helicopters are available in the surrounding region.

Figure 3: Taking mapping photographs from a helicopter at Haderburg Castle in South Tyrol.

The key thing is to obtain high-resolution images from a frontal position at close range. They form the basis for optimal evaluation and interpretation. This image planning – which also applies to 3D scans – is a requirement for this and can be demonstrated to the client via the images or the original scans. This is an important step for quality assurance.

Until then, and until the orthophotos are taken, only special technical expertise is required. By contrast, informative architectural survey drawings are a completely different matter. They require particular understanding of historic building designs, architectural forms and features. There are justified doubts that the results can be obtained from images only. Whether stereo mapping photographs permit spatial views, or orthophotos or a 3D-point-cloud plot have the best resolution – it is still just the interpretation of images. In ideal conditions, classic stereo evaluation can of course be used to reliably identify the shape of stones and interpret the architectural forms.

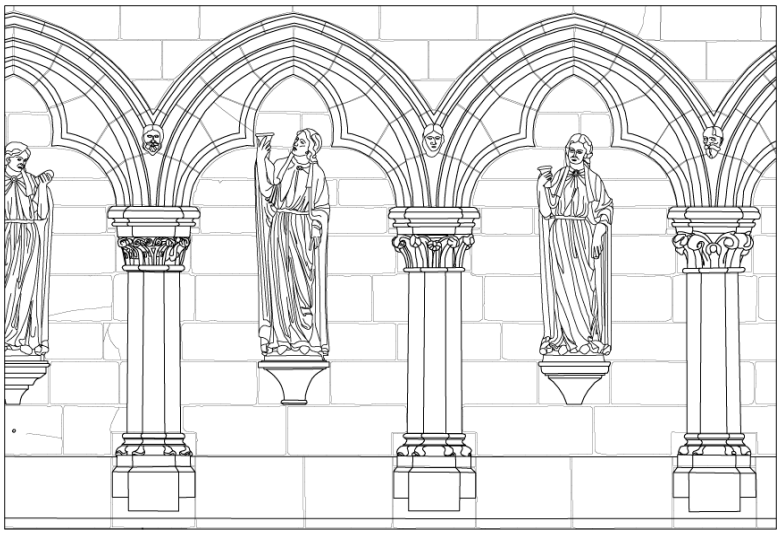

Figure 4: Excerpt from west façade of Bremen Cathedral, original scale 1:20

However, in other cases, intensive reworking from subsequently added scaffolding may be required. Areas masked by parapets, pinnacles and sculptures must be supplemented. The 9000 blocks can only be clearly identified via intense examination on site, as a result of covered or encrusted gaps.

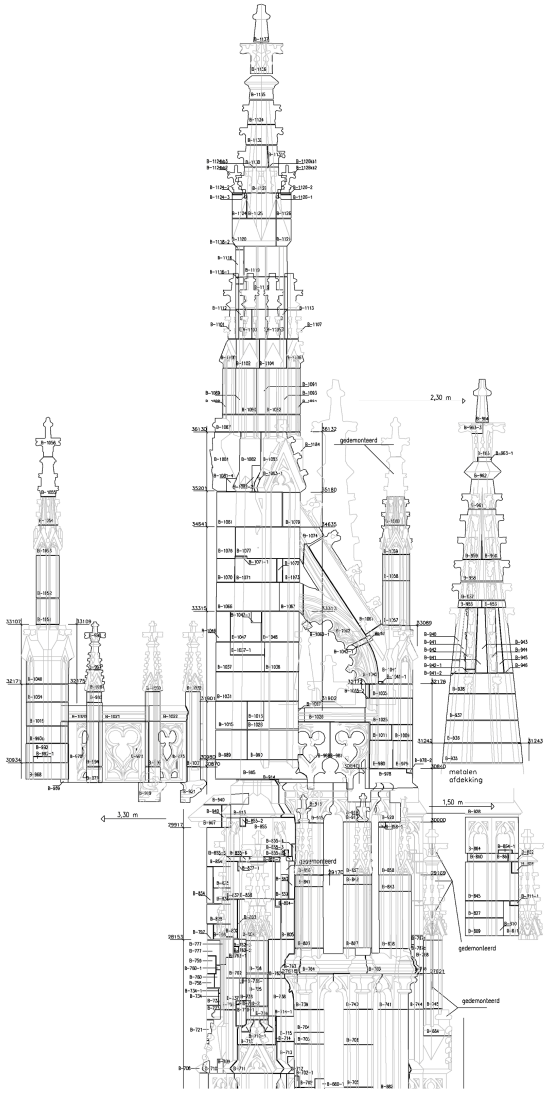

Figure 5: ′s-Hertogenbosch, Sint Jan Cathedral, part of western transept, original scale 1:20

Thus, we need more than simple (scale) images of the architecture. There are a range of other requirements above and beyond technical expertise. Surveying engineers who offer their technical solutions only will surely run afoul of their clients. The services required for informative architectural surveys primarily consist in the examination and presentation of the construction situation. Measurement and drawing is just a tool for this. Drawings themselves are already an interpretation, which involves exclusions, generalisations and emphases. No matter how technically excellent the results, even a 1:1 model cannot replace the original (if it were possible to afford a 1:1 model).

The earlier manual architectural surveys were laudable, because the time taken to produce them allowed sufficient time for observation and reflection – the tachymetric surveys which are standard today are the closest modern equivalent.

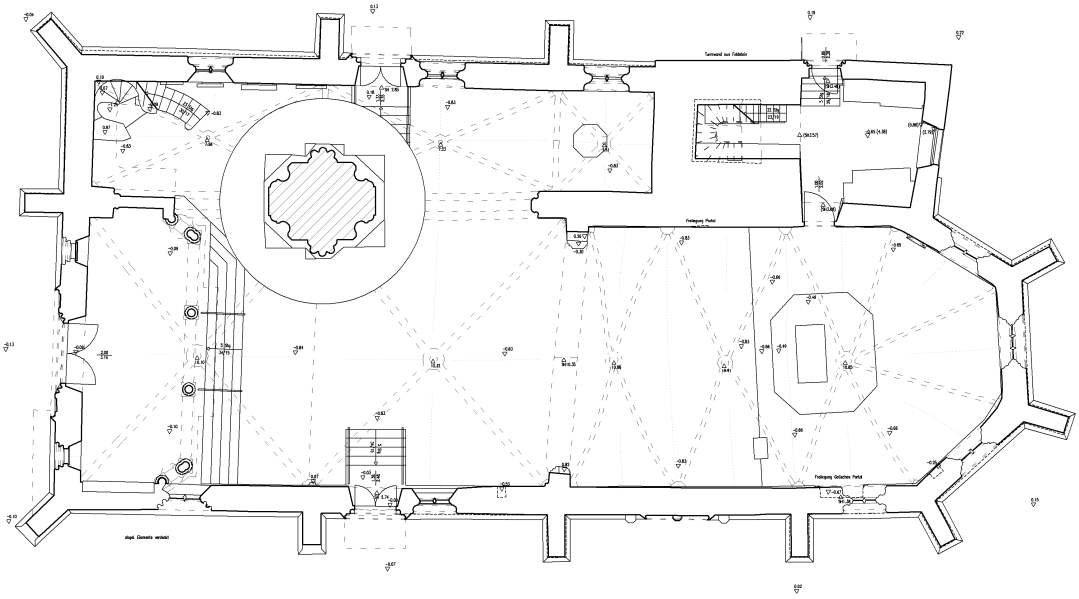

Figure 6: TachyCAD survey of Terlan parish church,
showing profiles in detail to allow output at a scale of 1:5 (emphasis).

In addition to the architectural and building design features, it is important to learn about the use of the building. In the example of the mill in Delft, this involves not only the highly deformed building envelope, but also the power transmission and material transport technology. This is a typical aspect of technical monuments. All of this must be presented in clear architectural survey drawings.

Figure 7: Molen De Roos in Delft

3. QUALITY ASSURANT TASKS

Quality is suitability for the intended use. It only makes sense to invest the money for an architectural survey if there is planning security for the renovation and restoration project. A thoroughly planned concept for architectural surveys and preliminary studies guarantees that all information required for detailed planning is provided, thus allowing reliable costing. Some people have not grasped this – apparent savings at this point prove costly at later stages. The competition on this specialised market is often focused exclusively on the lowest price. However, fair competition is only possible with clearly defined conditions. With a few commendable exceptions, architects do not learn enough about the constantly changing surveying technologies. On the other hand, the surveying experts probably do not learn enough about what architects need. That is a pity, as it is essential that both sides cooperate.

The few examples are intended to show the extent to which the quality of an architectural survey depends both on the various content requirements and on specific technological conditions. General references to overall requirements such as the familiar levels of precision are not enough [3]. That was not what Günther Eckstein intended. Each task must be specified precisely with verifiable requirements and conditions taking the following into consideration:

- Current (and future) renovation tasks,
- Building properties, construction and design conditions and unique architectural features,
- Specific local conditions (such as accessibility),
- Technological conditions essential for the performance of the task.

Expressing these concepts required comprehensive interdisciplinary knowledge. It would be an ideal performance description and a basis for tenders.

4. REFERENCES

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