

Visualisation of Martyr's Square, Beirut

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Abstract

Solidere, a Lebanese joint-stock company, was created by government decree in 1994 to reconstruct Beirut city-centre. The company, a form of public-private partnership, has a majority share holding of former owners and tenants of city-centre property. Several projects are underway, including the redevelopment of Place des Martyrs, once the bustling heart of Beirut but badly damaged during the war. Urban planners in Beirut have recently developed a 3D computer model to visually describe the spatial characteristics of Martyr's Square and its context, prior to inviting design proposals for an international competition. This paper describes issues pertaining to the development of the model to meet the needs of urban designers and town planners. It also considers potential future uses of the simulation, outlining areas for further research and development.

Keywords

Beirut, 3D Modelling, Visual Simulation, Town Planning

1. INTRODUCTION

Beirut is a city with a rich heritage and a fascinating history. It is currently recovering from a long and tragic period of civil war which ended in 1990. Many players, local and international, are currently working together with common aims - to rebuild Beirut and its infrastructure to help regain its former position as a commercial and financial centre in the region. The vision for the reconstruction of Beirut resulted in the formation, in 1994, of a private sector real estate company called Solidere (Société Libanaise pour le Développement et la Reconstruction du Centre-Ville de Beyrouth). Solidere is a joint stock company and its main objective is to develop the entire city centre of Beirut, an area of 1.9 million square metres. An extensive and ambitious Master Plan has been developed to form a framework for the restoration of the city. The plan has evolved flexibly to encompass new guidelines, priorities and refinements, but it has remained consistently definitive on the three-dimensional criteria for proposed building designs. Maximum building heights, building lines and façade controls on all main streets are some of the criteria viewed as essential constraints to ensure a good urban design for Beirut [Gavin96].

2. PURPOSE OF VISUALISATION

The redevelopment of Beirut has resulted in the need for several representations of the city. These have ranged over the years from two-dimensional plans, sections and elevations, watercolour perspectives, three-dimensional physical scale models to three-dimensional computer models. These forms support the premise that perhaps it is heterogeneity of techniques which provide the best representation of our built environment [Giddings02].

An early 3D computer model of the Master Plan was created because of a need to prescribe maximum building heights to protect the scale of buildings adjacent to the historic centre. This model was designed to show the topography, retained buildings, roads and open spaces as well as the maximum *building envelopes* of new designs. The Master Plan uses *streetwall controls* to form traditional streets and provide streetscape elevation controls. The roof plane is also considered important as many roofs will be overlooked. Solidere developed this three-dimensional computer model to be used as an interactive urban design tool which could be used to consider building footprint and massing options, as well as maintaining a record of floor space and proposed land use by parcel, block and sector [Gavin96].

2.1 Visualisation of Martyr's Square

A requirement to incorporate animation into the three-dimensional computer model came about when considering the development of Martyr's Square, a place of significant historical importance in Beirut, and preparing for a major international urban design competition for the Square, the zone around it and its new extension to the sea, forming the Grand Axis of Beirut. Martyr's Square has historically been Lebanon's most important public space, a popular meeting place for locals and visitors alike. First called 'Al Bourj' after the medieval watchtower which stood at the SE corner of the Square, it became known as Canons Square after a large artillery piece was placed in the Square during the Russian occupation of Beirut in 1773. It was named Martyr's Square in commemoration of the Martyr's of the Lebanese Independence, who were executed there in 1918.

Plans for the city prior to civil war had considered opening up an axis from the Bourj to the sea.



Fig. 1. Aerial View of Martyr's Square from the Marina – Axis to the Sea

Respect for this idea, and a concern to introduce 'view corridors' in the Master Plan resulted in an axis being designed to run from Martyr's Square across the first basin of Beirut port, to the sea (Figure 1). As the Master Plan evolved a number of additional view corridors were defined to maximize views of the Mediterranean as well as the mountain backdrop to the city seen across the bay. Two view corridors looking eastwards to the mountains intersect the main view corridor from Martyr's Square to the sea (Figure 2).

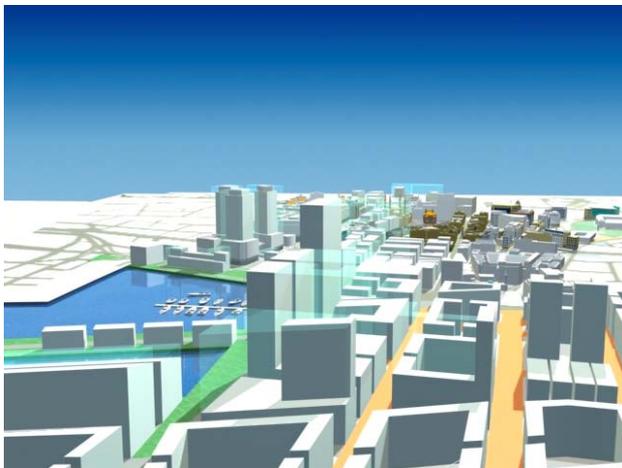


Fig. 2. Aerial View from the East – View Corridors

2.2 International Competition

An international competition is currently being launched by Solidere to invite leading architects to submit design proposals for this historic area. Solidere felt that an animated three-dimensional model of the axis would help designers quickly gain an awareness of spatial characteristics, massing plans, design constraints and context of this significant place. A representation was required to enable specific views from points of interest. The initial three-dimensional computer model for the Master Plan had been produced in-house using local expertise and commercially available software. In order

to implement a representation of Martyr's Square which incorporated animation and interactivity it was decided to engage the use of specialists in this field. A UK company of landscape architects and environmental consultants were commissioned to work with Solidere to produce the required end result. Their brief was to produce a computer representation which would provide a massing study of the Martyr's Square axis and an animated fly-over to contextualize the axis within its surroundings. The representation was required to be output on both CD and via the WWW.

3. PROCESS OF VISUALISATION

A systematic process of data capture, monitoring and review was undertaken to produce the required end results [Horne04]. Data was required for the terrain, road and pavement networks and buildings. Existing 2D city plans provided a source of data and part of the area had been previously modeled, in 2D and 3D, in AutoCAD. This geometric data was sent to the UK as email attachments or CD. The widely used, commercially available software platform of AutoCAD aided compatibility. Data was refined to provide the appropriate level of detail and imported into Superscape to create an initially simple, interactive model. This was valuable during initial meetings with the client when discussing the required position of the final fly-through. Coordinates of building footprints were accurately 'knit' to those of the terrain.

Details of the street wall sections, street furniture and landscaping were also provided. It was agreed that textures, materials, finishes and colours of existing buildings would be gathered via a photographic survey conducted by the UK team during a visit to Beirut. Also some technique was necessary to distinguish existing buildings from the maximum *building envelopes* of new designs. Figure 3 shows a representation of the building envelopes, incorporated in the Master Plan to aid the massing of new developments. The building envelopes were modeled to appear transparent, yet provide a sense of scale relating to the possibility of future developments.



Fig. 3. Aerial View over Place de Martyr's

4. END RESULTS

Figure 4 shows an image from the final fly-through of Martyr's Square. The final animation involved the rendering of 6000 frames in 3D Studio and took 1015 hours to complete.

In order to be used for important design strategies such as a model must be credible. Confidence is essential in the accuracy of the digital terrain model and the data capture techniques used in identifying the positioning of the buildings. The effectiveness of this visualization, and reliability of the end results, was aided by outsourcing to a company who has experience in the simulation of environmental projects, and who employ built environment professionals who have an understanding of the planning process. The client, by outsourcing this project to a UK practice, was able to assess the benefits of the technologies with minimum risk. Outsourcing increases flexibility, enabling a company to move to different solutions faster as it is not locked into a particular set of technologies due to staff competencies [Whyte02]. However outsourcing does require appropriate skills within the client's organization in order to collaborate with the model-building company.

The 3D model is an acceptable representation of Martyr's Square, with sufficient details to communicate the spatial characteristics and context. The detailed geometric modeling in this project was done using Autodesk Architectural Desktop. The difficulty in any modeling work is knowing when to stop, as further details and geometry can always be added. Usual restraints of tight competition deadlines and the initial project brief emerge as influencing factors. It is important that the costs and effort in making an animated model support its purpose for the specific context in which it is to be used [Suneson02].



Fig. 4. Aerial Overview

Decisions had to be made throughout the modeling process on the level of detail accurately represented on the building facades and when to use geometry or apply photographic techniques. Issues of data size need to be addressed when modeling urban environments as the volume of data can make the model unwieldy and the

animation slow. It was necessary to simplify much of the CAD data that had been supplied, removing unnecessary polygons, in order to produce an acceptable end result. A combination of detailed geometry and photographic techniques were used in this model. Adobe Photoshop was used to create the custom texture maps required. A continuous process of review and feedback followed in order to ensure the accuracy and appropriateness of the final end result.



Fig. 5. Place de Martyr's – Streetscape including Statue

Figure 5 shows how the model evolved to incorporate streetwall controls, outlines of potential buildings as well as the simulation of street furniture and landscaping. Even statues of important historical significance, damaged during the war but now restored, were included in the model.

The medium of CD, chosen for its conciseness and portability, enables the end result to be circulated efficiently to competition entrants. A smaller file-size version was produced for the client's competition web site. The end results also demonstrate what is possible to achieve with commercially available software and a hardware specification typical of that in many offices.

5. CONCLUSIONS

This case study has shown how a three-dimensional computer modeling has contributed, as a means of representation, to the historic city of Beirut. It has illustrated the following:

- Commercially available CAD software can contribute towards the visual simulation of a city and provide a common platform for dialogue and understanding between interested parties. Whilst the software can be used to build the geometry of a scene in great detail, this geometry will require refinement in the animation software in order to provide the interactivity or movement required.
- Urban models have much potential if based on accurate data. A smaller, specific section within an urban area can be modelled to illustrate the benefits of being able to walk-through or fly-through a scene. If the urban

model subsequently develops into one of a larger scale then issues of structuring and management of large urban databases need to be addressed.

- There is potential for digital city models to be used for a variety of purposes. The database of geometrical information can be developed to one containing other urban attributes, including historical information. Urban models in the UK have proven to be genuinely useful to a wide range of users [Ennis99]. In the US a VR model of Los Angeles has effected ongoing research investigations into the diverse applications of computer based urban models, including education and cultural tourism [Jepson 98]. Bourdakis considers that urban VR models fall within three main categories: design and planning, education and general research, commercial and entertainment [Bourdakis98].

5.1 Future Work

Feedback from the users (competition entrants) of the model will be collected to analyse the effectiveness of the visual simulation as an aid in assessing the spatial characteristics, design constraints and context of Martyr's Square. Solidere is currently considering further 3D modeling of the city-centre to produce an urban design tool that can be updated in-house and used:

- to generate 3D massing diagrams, set in the urban context, for individual parcel development briefs
- for submissions made to the Higher Council for Urban Planning to show the urban context for any future large project
- for submissions made to the Higher Council for Urban Planning to show the urban context for any project seeking a Master Plan Amendment
- to show progressive growth of street landscaping and public space planting, within the urban context, in five-year increments

They seek to develop a rational layering system that will be appropriate for the way urban designers and town planners need to work.

Bourdakis advocates the development of custom tools for urban scale simulations, which perhaps will meet some of the requirements outlined above [Bourdakis01].

The importance of 3D reconstruction of buildings, cities and urban landscapes is becoming more recognized and acknowledged. This case study offers an insight into an application of current technologies for a city with great potential for the future.

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