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Menlyn Maine Precinct Infrastructure Project Phase 1

INTRODUCTION

Menlyn Maine is located in the Menlyn development node to the east of Pretoria where the developer, Menlyn Maine Investment Holdings (Pty) Ltd, bought out 103 residential dwellings for re-development. It is a mixed-use precinct development with total development rights exceeding 300 000 m². This 11,4 ha development, comprising 16 land parcels, include the development of offices, showrooms, shops, restaurants, banks, residential units and an hotel.

WorleyParsons was appointed as the developer's consulting engineers for all the infrastructural components relating to the project. The main WorleyParsons disciplines involved in the project are civil, electrical, transport and management services. The first phase of the project included the upgrading and construction of roads, as well as the installation of all the normal services associated with a township development, i.e. stormwater, water, sewer, electrical and telecommunication networks.

The uniqueness of the project lies in its ambitions of being an innovative, world-class, environmentally sensitive lifestyle development focusing on sustainability. The project was selected as one of only 16 international projects to be endorsed by the Clinton Foundation as a model project in sustainable development. This requires a purposeful focus on all levels of design detail. At a total development budget of R 6 bn – R 7 bn this project is truly an endorsement of the private sector's confidence in the sustainability of infrastructure related investments in South Africa.

QUALITY OF ENGINEERING DESIGN

The engineering design for the precinct and bulk infrastructure included the following disciplines:

- Civil (water supply, sewer networks, stormwater networks, streets)
- Roads/Transport
- Electrical
- Telecommunication
- Structural
- Hydrological

All designs conformed to the relevant SABS and Tshwane Municipality standards, as prescribed. Where such design standards were insufficient, designs were based on first principles and engineering experience. Design is one of the three pillars that the development was founded on – this resulted in additional scrutiny and focus on quality from the developer and his independent advisors. WorleyParsons was not only accountable to the developer, but also to their appointed external financial and technical advisors. This system of high accountability throughout the design and execution phases was welcomed, and even encouraged by WorleyParsons. The result was a quality end product of superior design.

INGENUITY, ORIGINALITY AND INNOVATION, COUPLED WITH ENVIRONMENTAL, SOCIAL AND ECONOMIC SUSTAINABILITY

Although most of the precinct infrastructure resembles standard infrastructure components, the application thereof was quite unique. The following are a few examples from an engineering, environmental and social perspective:

- **Rainwater catchment bio swale on the centre road median**
  A specially designed depression provides for maximum natural on-site attenuation and capture of rainwater runoff.
- **Construction materials re-use**
  From the demolition of 103 houses spoil materials were sorted, crushed, graded and stockpiled on site for use in selected sub-grade and fill layers during road construction, as well as for platform fill materials.

1 Artist's impression of Menlyn Maine
2 Rainwater catchment bio swale being prepared on the centre road median – the specially prepared depression provides natural on-site attenuation and capture of rainwater runoff
3 Median island constructed as a swale to attenuate stormwater. The invert of the swale is lower than the adjacent road surface and covered with vegetation. Surface runoff from the street is diverted into the swale via openings in the kerb line every two metres

- **Energy efficient lighting**
  Specially manufactured street light fittings were applied for maximum energy efficiency and LED technology was applied on all traffic signals.
- **Cutting-edge traffic signal controllers**
  Traffic cameras instead of conventional electromagnetic loops were employed to improve traffic flow control.
- **Integrated 132 kV Breaker/Isolator**
  Upgrade of the existing bulk substation (as opposed to constructing a new substation) was made possible by introducing a compact integrated 132 kV Breaker/Isolator unit very rarely used in South Africa.
- **Unique Developer Supply Authority Agreement**
  For the upgrading of the bulk supply infrastructure, a unique contracting model was developed by WorleyParsons and the developer, whereby risks were shared between the developer and the supply authority. This model enabled the upgrade of the supply authority bulk infrastructure without the internal municipal budgeting and financing constraints.
- **IT infrastructure**
  In order to enable the development to take full advantage of possible future developments in high-speed fibre-optic data network, a very unconventional, comprehensive cableway network was installed to cater for not one (as per the convention), but three full service provider networks. This would enable a full-fibre last-mile-link installation to be implemented in the future.
- **Special aids for the visually impaired**
  Special audio signal generators were incorporated in the traffic signal designs for improved pedestrian navigation (this application is a first for Tshwane). In addition the precinct was designed with provision for special warning and directional pavement tactile inserts to guide visually impaired pedestrians.

4 and 5 Close attention was paid to landscaping and paving to achieve a harmonious identity throughout the development

6 An on-site nursery was established to preserve and re-establish all the indigenous and endemic trees that were growing in the precinct prior to re-development

The services of a disability specialist were engaged to align the pavement designs to the guidelines promoted by the SA National Council for the Blind.

On-site nursery

An on-site nursery was established to preserve and re-establish all the indigenous and endemic trees that were growing in the precinct prior to re-development.

MANAGEMENT OF PLANNING AND TECHNICAL DESIGN

WorleyParsons employed production line and management services divisions for the design development and execution phases of the project. The conventional model of having the lead design engineer also taking responsibility for the planning and coordination of the design team was replaced by the WorleyParsons Lead Technical Project Manager model. Although this requires additional highly skilled resources to be deployed to the project, it results in a more effective allocation of work and an improved integrated planning and design function. A senior WorleyParsons Technical Project Director (PD) took the responsibility of ensuring that the design and planning phase was conducted within time, budget and to the appropriate quality specification. The technical design leaders were therefore freed up to focus on the technical aspects of their design with the PD having the opportunity to introduce a seamless value engineering process throughout the design phase.

AESTHETICS

Very close attention was paid to landscaping and paving to achieve a harmonious identity throughout the development.

BUDGETARY COMPLIANCE

The engineering services budget of R88,16 m (including contingencies, VAT and fees) was set upfront at the time of procurement, prior to commencement of the project. This budget was maintained

7 Artist's impression of Aramist Street – note the median island which was constructed as a swale to attenuate stormwater

8 Artist's impression of the Galleleo Piazza with landscaping

9 Artist's impression of the Falcon Nedbank building – note the environmentally friendly design

with monthly monitoring and reporting to the client's quantity surveyor. Despite several risk events materialising, such as groundwater seepage, existing services variations and supply authority specification variations, the project was completed within the original budget.

UNUSUAL CONSTRUCTION METHODS

The following is an example of how unusual construction methods were applied to enhance the long-term sustainability of the development: A portion of the median island in Aramist Street was constructed as a swale to attenuate stormwater. The invert of the swale is lower than the adjacent road surface, and covered with vegetation. Surface runoff from the street is diverted into the swale via openings in the kerb line every two metres. The velocity of the water is reduced by the vegetation, causing the water to infiltrate the soil. A subsurface drain along the length of the swale drains away excess water into the piped stormwater system, to ensure that the soil does not become saturated. The swale has the same gradient as the street. It is connected to the conventional stormwater pipe system by means of a grid inlet structure at its lowest point. Should the inflow rate exceed the infiltration rate, the swale will fill up and eventually overflow into the stormwater pipe system via the grid inlet.

INFLUENCE OF CONSULTING ENGINEER ON CONCEPTUAL DESIGN

For the Menlyn Maine project, the developer had the foresight to involve WorleyParsons from the conceptual development stage when the precinct was being conceived. This allowed WorleyParsons to significantly influence the layout from a technical point of view. During this process a regional master plan was developed not only for the development, but also for the Menlyn development node. This allowed for increased efficiencies in terms of the total infrastructure footprint, both in terms of sustainability and functionality. The integration of the engineering infrastructure designs with the development precinct objectives resulted in an improved ultimate product. A good example of this co-planning and design is the on-site stormwater attenuation pond that also serves as a landscaping feature and groundwater sink.

COMPLEXITY AND SOPHISTICATION

The overall precinct development posed few challenges in terms of engineering design, excluding the numerous innovative elements introduced into the project. The execution of the project, however, turned out to be more complex. Re-development of an entire township within a highly developed metropolitan area posed its own challenges. These included relocation of existing functioning services, traffic flow, service interruptions, noise and dust

control, pedestrian and spectator control, environmental sensitivity, inclusion of the future service needs of adjacent properties, area-wide infrastructure master planning, and related challenges. The solutions to these challenges required ingenuity not normally associated with this type of project.

RESPONSIBILITY CARRIED BY CONSULTING ENGINEER (RISK)

WorleyParsons was appointed under a Procsa Professional Services Agreement, in terms of which WorleyParsons took on all normal design and supervision risks associated with an infrastructure project. In addition, the company also took on the risk of a fixed fee for both the design and site supervision as per the planned program. Due to the externally induced delays experienced by the project, the company had to fund the significant supervision costs associated with the substantial extension of time. During this period the complete full-time WorleyParsons supervision service was maintained on site, despite reduced construction activity, and at no additional cost to the client.

RESPONSIVENESS TO NEEDS OF CLIENT AND COMMUNITY

In order to respond to the needs of the client and community WorleyParsons endeavored at all times to respond to a service request within 24 hours. This was made possible by placement of a permanent WorleyParsons presence on site, and through weekly visits by the company PD to the precinct. Issues such as dust and noise control, traffic flow control, pedestrian access, engineering services interruptions, and the like were very closely monitored. There was even a temporary road constructed on behalf of an adjacent school to alleviate traffic congestion and improve pedestrian safety during peak periods in an area outside the development precinct. This was done at the developer's cost.

MEETING THE CLIENT'S DEADLINES FOR READINESS

Very ambitious time lines were set for completion of this complex project. The first phase demanded WorleyParsons to develop and produce the designs, specifications and bills of quantities in a record time. This was done by delaying certain detail design components and local authority approvals until after the official procurement stage. This resulted in construction commencing on time as planned. The contracting regime employed for the project then transferred the responsibility of managing the program during the construction stage to a single main contractor. The contractor was given training and support by WorleyParsons to enable him to detail the construction progress on a project management software program. This was the first project where the contractor employed such electronic aids to assist with managing a project construction program. Ultimately the contractor was awarded extension of time, due to external delays in the approval processes. All parties – the client, WorleyParsons and the contractor – worked hard as a team to minimise the external delays experienced at the end. □

Source:
http://www.saice.org.za/downloads/monthly_publications/2011/2011-Civil-Engineering-july/#/0