Building Facility Development – The Renewal of a Car Plant without interfering the Production

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Summary

Future development of production sites in the motor industry require an integrated approach for design and realization of the building construction works as well as co-ordination with the production process to find on one side a feasible solution for the building construction and to allow on the other side minimized disturbance of the plant production out-put. If the plant is located in the inner districts of a city, the task will be complicated by taking the boundary conditions of the adjacent areas into account. To develop the answer which fits the needs of the plant management best, it is necessary to start the basic design considerations with a survey of the existing building, sufficiently deep to elaborate all necessary information, especially concerning material qualities, geometrical dimensions, actual loading conditions etc. Based on these, the structural concept chosen has to go beyond the usual measures taken in many aspects. For example techniques like incremental launching, well known from bridge construction, soil improvement by jet-grouting, the application of mono-piles for transferring the loads to deeper situated soil-layers or gluing for the application of strengthening elements are used. Another aspect of the design exercise follows from fire-resistance considerations. Modified regulations or/and a changed profile of use may yield to a new assessment of the structural qualities when exposed to fire.

Keywords: Renewal; Modern construction methods; Integrated design philosophy; Soil improvement methods; Classification of old materials; Supervision and inspection on-site

1. Introduction

Due to the fact, that in recent years the cycles for introducing new and more refined production methods and techniques in the motor industry are considerably accelerated, a persistent development and renewal of the existing building facilities of car plants is required to meet all these challenges. In addition to the technical questions the designer's job is complicated by the boundary conditions resulting from the number one criteria "The production must go on". Hence the development of the building facilities of a car plant differs in a lot of aspects from the scheme known from typical commercial building constructions. It is exemplified in the following by explaining the actual development of the original BMW production plant – Plant #1 – in Munich (Fig. 1).

2. Technical Boundary Conditions

The relevant technical boundary conditions underlying the design of the buildings reflect in most cases the serviceability limit state. Especially the robot-based assembling and welding processes lead to severe restrictions concerning deflections and accelerations of the structure. The traditional analysis methods which are based on the assumption of independent systems, are deemed to fail under these circumstances.

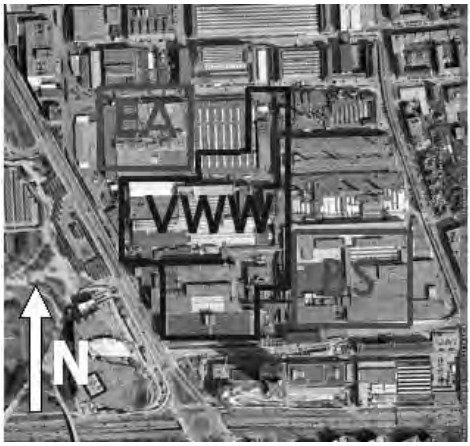

Fig. 1: BMW Plant #1 in Munich

3. Buildings/Constructions

3.1 Visitors Walk Way – VWW

Touching most of the relevant production sites of Plant #1 – starting with the elementary powers of metal forming in the Press Shop, passing the Body Shop, the gear- and the engine-assembly and ending in the Final Assembly Building – the Visitors Walk Way gives visitors the chance to experience car production and general logistics – delivery and shipping – of the plant – maximum output per day equals about 1.400 cars –. The design of the Visitors Walk Way is based on the concept of a sequence of bridges with spans up to 60 m, both inside the buildings for giving the visitor a survey over the production and outside for connection purposes.

3.2 Substitution of the Body Shop – BS

The existing Body Shop comprises several independent structures of different development stages and ages, ranging from fifteen to fifty years. The introduction of gluing as a major part in constructing the car body led to the requirement of special workplaces for this technology. As Fig. 1 indicates there is not enough space both inside and outside of the existing buildings for extension measures. The solution chosen was, to build in a top to bottom approach a complete new building above the existing structures, and to replace these thereafter. The floor-slabs, usually a grid of rolled steel beams and light decking components made out of grating, were for both parts, the new top structure and the replaced old ones, suspended from the main-frames of the new structure.

3.3 Revamping of the Engine Assembly Building – EA

By reconstructing the roof-construction – a shed-roof comprising of prestressed concrete hypar-elements with a thickness of 16 cm was replaced by a steel construction and a decking with trapezoidal-metal-sheets – the necessary strengthening and the improvement in lay-out-flexibility was achieved. The work on the roof-construction was accompanied by strengthening measures at the vertical load-bearing components and at the stabilizing elements. Special emphasis was laid on the question of the necessity of improving the foundations of the construction by jet-grouting, as the circumstances for doing this work were quite demanding.

4. Final Remarks

The three examples presented in this paper give only a first impression on the task of the renewal of BMW Plant #1 in Munich. The reconstruction and substitution of the different buildings will go on in the future, and they will integrate the new and re-developed facilities of the BMW-Welt and the BMW-Museum. The examples presented in this paper mark the first steps in reorganizing and renewing a complex production site. Further steps will follow, based on the experiences gained.

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