Selection of Software Products for the Development of a Calendar Plan for High-Rise Construction

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Abstract. The paper discusses popular software products for the development of a high-rise building calendar plan, such as Rillsoft and "Hector: designer-Builder. Selected automated systems development schedule are necessary functions of data processing, have the ability to filter, display, alternating different sets of data, consideration of their sequence and interrelation; a sequence change data sets and correcting the data. When defining the work item has an opportunity to address their implementation in a variety of ways: with a "standard" single-variant technology; with recommended production technology; multiple technology. The content of software systems is unequal, and they contain extensive graphic and text databases, a comprehensive library of normative and methodological documents, numerous technological guides, a library of technological schemes and standard technological maps, examples of the development of organizational and technological documentation. Work in software complexes was carried out both in local mode on the separate computer, and in a network mode with support of simultaneous work of several users in a local network. The program modules which are a part of program complexes which are intended for the automated decision of the most difficult and labor-consuming tasks of organizational and technological design according to requirements of the operating normative and methodical documentation were used. It is concluded that a more detailed analysis of programs is needed to select the most optimal range of tasks for each software product.

1. Introduction
Construction schedule is a set of design and manufacturing documents, establishing the procedure, the sequence and timing of the necessary works on the construction of individual objects or complexes of buildings and structures. Construction schedule is delegating the activities of all organizations involved in construction [1, 2]. Construction schedule is different from a work plan that is "bound" to the real calendar (starting from the beginning of the work day in the relevant month with the exception of holidays) [14, 15].

Construction schedule allows to properly organize the process of construction of the industrial complex, to ensure the availability of necessary equipment on construction site and human resources at the right time [9, 11]. It is also helps to avoid downtime which leads to irrational spendings.

In modern construction there are variety of computer programs that may be used to create construction schedule [10, 12, 13]. The difference between these programs is in quantity and quality of relations between the used data features, visual representation of resource allocation in time and cost.
Some programs allow to make a redistribution of resources based on their demand in a given period in automated form [16, 17, 18].

2. Methods
The tasks of the automated development systems of a construction schedule includes: preparation of initial data, the compilation of a list of construction subjects, composition of the work list and conditions of process implementation, the volume of resources required and more. This step can be implemented by consistent viewing of a number of variables and the choice of necessary for construction schedule generation [24, 25, 26].

In the automated development systems the following functions should be provided: filter that allows you to choose the data that must be corrected; display and the ability to interleave different data sets; data validation, consideration of their sequence and interaction; changing the sequence of datatasets and the data themselves (including a few sets), etc [21, 22]. When defining the range of works it is necessary to take into account that their implementation is possible in different ways: with the "normalized" single-variant technology; with recommended production technology; multiple technology (possibilities are limitless). In the latter case, this step is combined with others, in particular, with the choice of methods of works [5, 7, 20, 23].

The main criteria for the construction schedule creation are: minimization of deviations from the specified period of time; profit maximization; minimization of production losses; minimization of construction costs; minimization of the amount of resources used.

Main objective of creation of the construction schedule is to describe the tasks, activities, available resources, and define relationships between them using the assignments.

Planning begins with the definition of the object and its key characteristics. Then a task list and a list of required resources must be prepared. After this the additional information which will be used in determining appointments in the future when carrying out works according to plan (monitoring plan) must be included in schedule. Finally, the project must be optimized if the duration or budget is more than expected [3, 4, 6].

The task of project planning is to accurately assess the timing of execution and the cost of these works. The more accurate the estimation, the higher the quality of the project plan [16, 21].

To give an accurate estimate, you must know what work needs to be performed to obtain its result. Only after creating a list of work, duration and required resources of each work can be calculated. And only then you can estimate the cost and deadlines of each task and, as a result of addition, the total cost and project duration.

3. Results and Discussion
In this work, we will examine the most popular programs pertaining to the organization of construction, namely: Rillsoft and Hector.

Computer program Rillsoft Project is designed to create optimal construction schedule, control, analysis and project management.

Scheduling is an important element in successful implementation of projects. Especially if you run multiple projects at the same time in addition to problems of distribution of resources and facilities is an urgent issue deadlines of completion [19].

Rillsoft Project will help you to implement scheduling professionally and flexibly, offering the following functions (figure 1):
- Creation and presentation of the project plan in different views, for example: Gantt chart, Network diagram, Gantt processing.
- The interdependence between work allow in case of delay or advance automatically recalculate deadlines associated works
- The connection can be set to different delays, for example, the absolute, according to the working calendar or relative.
- Hierarchically independent of the work can be presented in a single row on Gantt chart
- Using subprojects, works, milestones and WBS codes helps to structure the project
- Calculate and display critical path and the backup time significantly simplifies the detection of bottlenecks of the project
- Forward scheduling and backward scheduling
- Repeated work can be saved as templates and used for future projects
- External links to documents, for example, graphics or Excel files
- Interactive presentation of the project in the Intranet/Internet using an XML format.
- Balance and resource planning: personnel planning based on specialties, the use of teams, load and resource balance, the need for materials, and loading equipment.
- Multiproject management: scheduling for all projects of the company: the balance of resources in the multiproject, optimal resource utilization in a multi-project (figure 2).

![Rillsoft Project Interface](image)

**Fig. 1.** Rillsoft Project Interface.

As a rule the resources of the enterprise are busy in many projects. Presentation and processing of all projects of the company in the total multiproject is the basis for optimal allocation of resources and realistic assessment of the duration of the project.

Rillsoft Project allows you to load all projects of the enterprise in the portfolio for analysis, comparison and processing.

The allocation of resources in the balance calculation of the personnel proposed on the basis of priorities of the projects within the multiproject. Arbitrarily define the category and status of the project allow you to sort and group the multiproject according to the selected criteria.
Fig. 2. Presentation and processing of all enterprise projects in a common multi-project.

In the multiproject almost all actions proposed in a separate project are available: scheduling for multi-project, calculate the balance of resources including employment in all projects, optimum loading of employed resources.
If the Plan/Actual Comparison in the multi-project each project is compared with its basic plan that is set in the project properties.

The basis of the Integration server is a centralized and automated management of project data in a so-called repository (figure 3).

This is centralized database, which is accessed from the Rillsoft Project or other software through SOAP (Simple Object Access Protocol).

![Diagram of server connections](image)

**Fig. 3.** Design of the system of access control based on roles in Rillsoft Project.

Another basic component of the Integration Server is the system of access control based on roles.
- Multi-user system: completely independent structure for different enterprises, their resource pools and users.
- Differentiated access rights: for all project participants access to information depends on their role.
- Time tracking: accounting for time spent, the status of the project.
- Save all actions in the log: the logging of user actions and versioning of records.
- Cross-project dependencies: the timing of follow-up projects does not change automatically, and set a negative delay time for cross-project communication.
- Version control: all project versions are stored in the archive indicating when and who made changes, and it is possible to go back to earlier versions of project if needed.
- Additional modules for RIS: E-Mail newsletter, LDAP Interface for users autoryzowany, the iCalendar Interface, Timeline, Data exchange with Redmine, Recording time, Planning vacations.

Program "Hector: estimator - Builder" allows you to create, calculate, correct local, object and consolidated cost estimates and acts of acceptance KS-2, cumulative Bulletin (KS-6A), the certificate under the form KS-3, statement of needs and the write-off of materials (M-29), a statement of the actual cost of materials and increased cost of construction (figure 4).

Program "Hector: estimator - Builder" provides effective means of work with regulatory regimes, including the use of multiple bases by hitting one of the estimates, creating and using standard work packages, preparation of lists of works with the given keywords in the names or compositions, works, used resources etc.

Acts of completed works, KS-2 can be compiled to one estimate, multiple estimates, or without estimates. For each position of act there is an automatic calculation for a given percentage of completion or the amounts. Works that are not in the estimate may be included in and automatically calculated. Also there are automatic associations of sub acts in a General contractor.

Output forms are implemented using the built-in report generator and can be easily changed, the results are displayed using MS Word or Excel, Writer and Calc (OpenOffice.org). You can also view and enter data directly in the output form. Also there is a unit of account of actual prices for materials.
as well as a number of functions for monitoring and calculation of indexes for regional pricing centers in construction.

The program provides opportunities for the examination of the estimate documentation [22]. The results of the examination are displayed in the Protocol are displayed on the screen. Possible automatic adjustment of the local budget according to the results of the examination.

**Fig. 4.** "Hector: estimator - Builder" Interface.

The calculation setup of additional charges (overhead costs, planned savings, etc.) is performed without entering the formulas.

For the training program developed electronic lessons explaining technology solutions to the key issues for the development of estimate documentation.

The program can run on a separate computer and local area network.

In addition to the program, different modules can be connected:

- "Universal" – for editing, printing, and view of the local estimates and acts of acceptance in the ARPS format on any computer without installing program estimates;
- "Schedule" - construction schedule of works on the basis of the local budget, monitoring of implementation of acts of the executed works, receiving schedules need in machinery, materials, workers;
- "Payment" - payment for work performed;

It is possible to automatically prepare data according to the write-off of materials by using programs "Hector: warehouse-materials" and 1C accounting. You can download construction estimates from other programs (AVS, ARS, AVERS, WinSmeta, Bagheera, the leopard+, Wizard, etc.); fully supported unit of exchange estimate information ARPS 1.0/1.10, which is required for the design and construction of high-rise objects of the state order.
The program can be work on a separate computer and local area network. In addition to the program can be connected the module of mutual settlements with customers and subcontractors and module of autonomous adjustments estimates "Universal", allowing you to edit, print in any form and save the local budget, and acts of KS-2 on any computer without installing the program which is very convenient for the customer, the facility, etc. Program can be also delivered on a flash drive, combined with an electronic protection key (module “Mobility”). At the same time without any installation of the software to any computer you can load the local estimates, the summary estimates, statements, write-off of materials, estimates for design and survey work, to unload and load information in the format of ARPS. Also the library of public estimates is supported. Each user can select the appropriate estimate, and give their own estimates for inclusion in the library. It is possible to automatically prepare data according to the write-off of materials for use in accounting programs. You can download estimates that were created in other programs and also have fully supported unit of estimate information exchange called ARPS (Association of software developers for construction). It is possible to calculate estimates based on source data from CAD systems, including programs AllPlan, obtaining dimensions from the AutoCad drawings.

4. Conclusions
We reviewed the most popular programs for scheduling in construction. The choice fell on these products, as they are the most functional than others. Actually, it would be much interesting to have in-depth and detailed analysis of these programs in order to identify their advantages and disadvantages and determine the most optimal tasks for each program. But it’s too hard due to the fact that functions set of this programs do not differ from each other.

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