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WELL DESIGN USING LANDMARK SOFTWARE*

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Key words: drilling, computer model, wellbore design

Abstract: Actual well design challenges require using more sophisticated methods. Halliburton company (Landmark) software is one of the top industry solutions. For drilling engineer it is very important, to have possibility make all calculation from the beginning to last stage using the same software. Paper presents some possibilities of using programs like: Compass, CasingSeat, StressCheck and WellPlan for wellbore design. In the first step trajectory and anticollision can be established in Compass. Later on casing construction problems can be solved using CasingSeat and StressCheck. At last step drilling technology process can be designed using WellPlan.

1. Introduction

Contemporary wellbore design process often involves directional wellbore issue. This area shows many new challenges for engineers [1]. Important element of contemporary wellbore design process is cooperation between people in all decision levels. Landmark software enables such assistance. From management to field engineers each one uses the same data base EDM [6]. This way possibility of mistakes is minimized because everyone works on the same set of data. Correlation between Landmark drilling design programs is shown on figure 1.

2. Casing Design

Compass is broadly used in industry do find the best trajectory of the well, meeting all geological and production targets as well as some technological aspects. Multiple offshore wells are usually drilled from one location. In this case strongly important become question of possible collision between drilled holes. This problem can be solved using anticollision module. Existing survey data may be used to continue given well, design multilateral wells, check collision possibility, etc. Results can be view in 2D or 3D (fig. 2). When trajectory is calculated casing has to be designed.

CasingSeat is user friendly tool to design particular casing depth. First step is declaration of available hole and casing diameters (fig. 3) and description of geological constraints as well as technological limits. Based on pore pressure and fracture gradient user defined constraints are calculated. Next is defining boundary conditions like lithology properties, wellbore stability, differential sticking and minimum overbalance. As a result program calculates possible casing depts. Example results are shown on figure 4.

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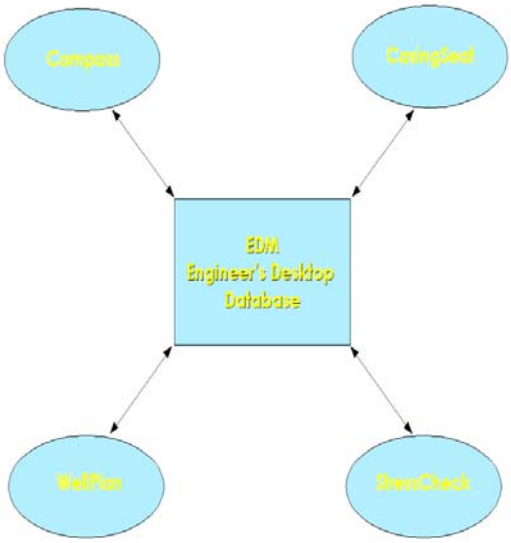

Fig. 1 *Correlation between Landmark drilling design programs.*

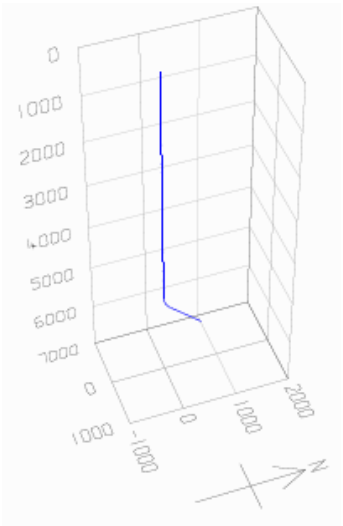

Fig. 2 *3D view of trajectory.*

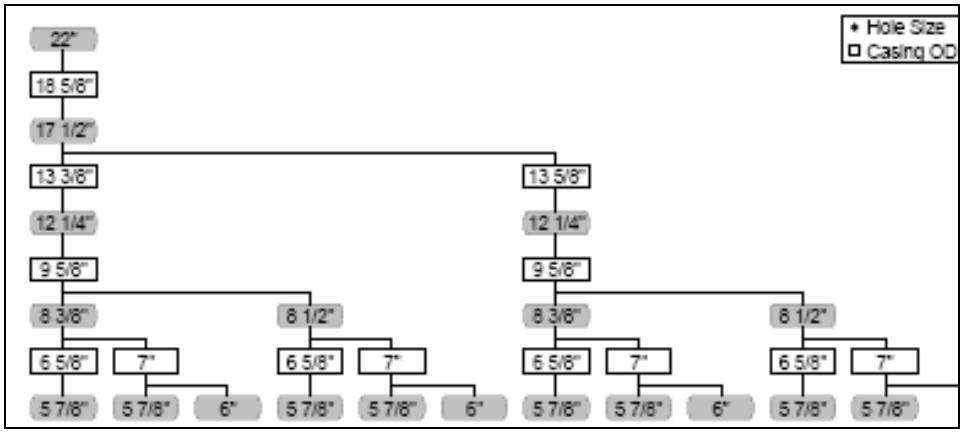

Fig. 3 *Available well configurations.*

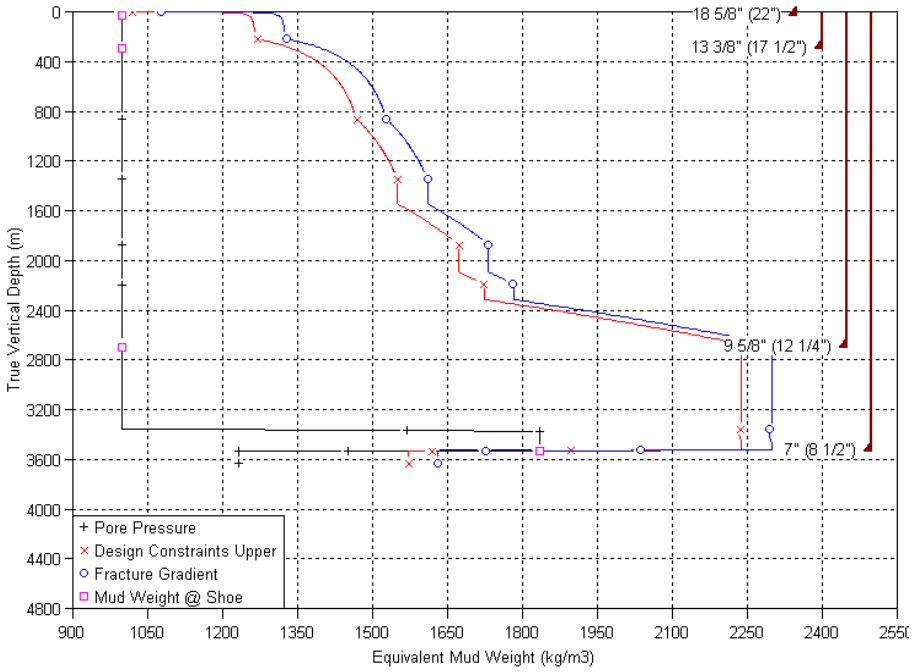

Fig. 4 *Example results from CasingSeat.*

Strength and cost of casing can be deeply analyzed using StressCheck. Apart standard considerations it offers many sophisticated factors in calculations. User can take into account: additional loads (running, installation and service), gas kick loads, external pressure profiles for good and poor cement, permeable zones, mud density deterioration, annulus mud drop, worst-case or user-entered temperature profiles, temperature-dependant and pressure-dependant gas-density profiles, overpull limits, allowable wear, pressure testing, automated minimum-cost. Example results are shown on the figure 5.

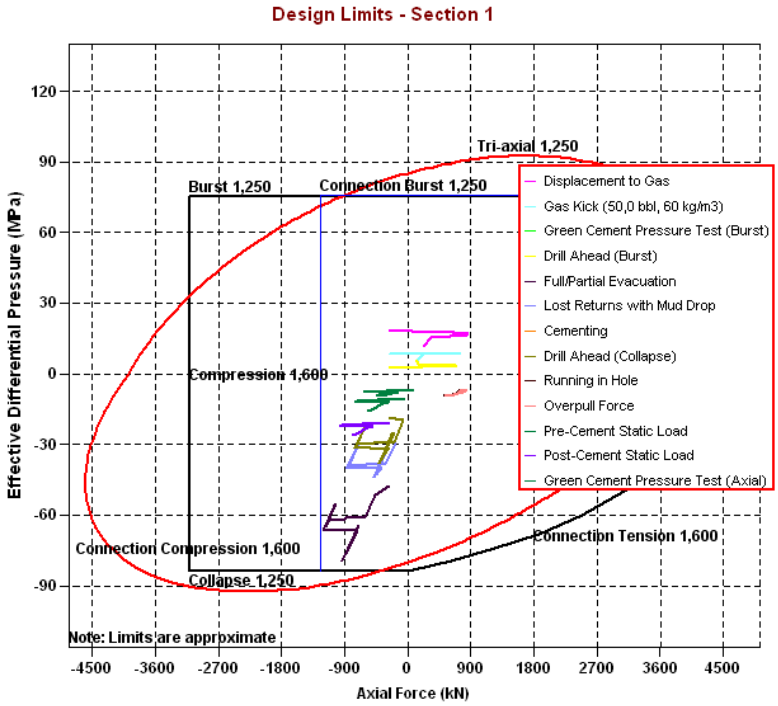

Fig. 5 *Results for casing section in StressCheck.*

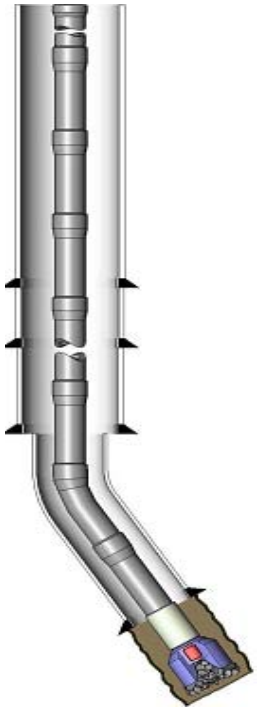

Fig. 7 *Drill string and casing visualization as a final result.*

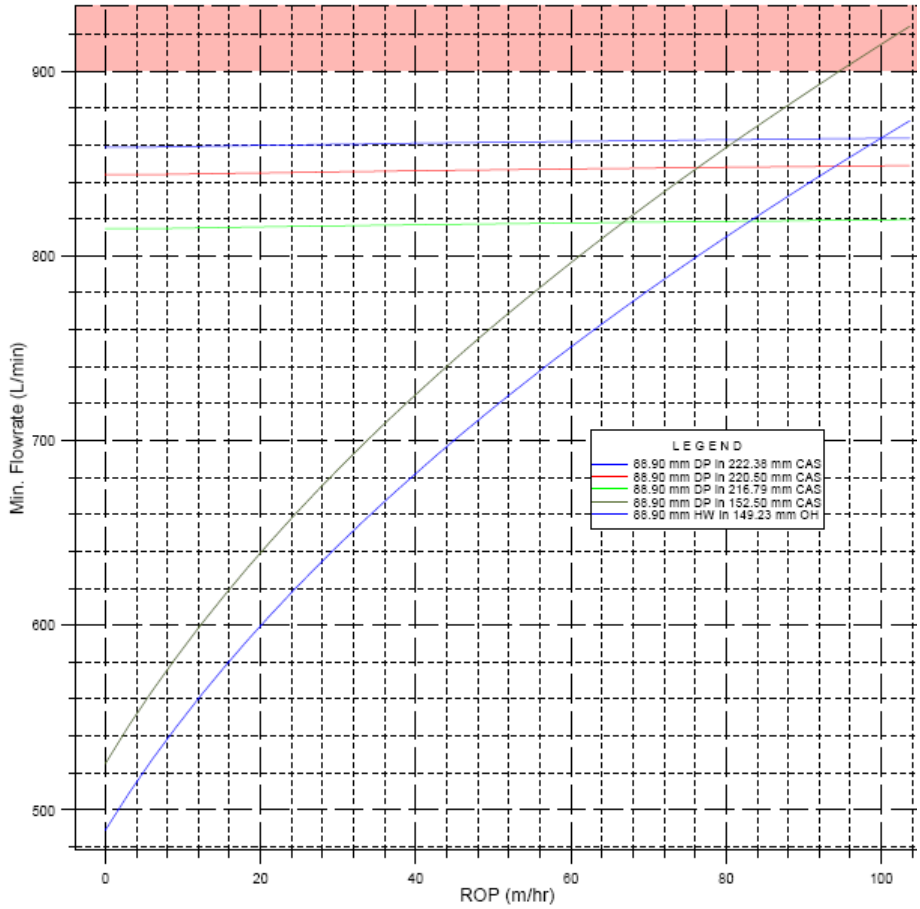

Fig. 6 *Minimum flow rate vs. ROP for designed drill string.*

3. Drilling process Design

Drilling wellbore process can be designed using WellPlan. It is very powerful tool as well for office as for field calculation. Because drilling the well is one of the significant costs for operating companies, it is important to minimize it already in design process. Also proper technical and technological choices reduce probability of drilling complications [2, 4, 5] and have this way significant impact on total expenses. Calculation is grouped in eight modules: Torque Drag, Hydraulics, Well Control, Surge, Cementing, Critical Speed Analysis, Bottom Hole Assembly and Stuck Pipe. Drill string, casing string and liner can be an object in Torque Drag module. For: tripping in, tripping out, rotating on bottom, rotating off bottom, sliding drilling and backreaming user can calculate measured weight and torque. Changing all components of drill string can be achieved the best set meeting strength targets [3]. In all modules results can be analyzed using tables or charts. Figure 6 shows example chart in Hydraulics module. This module is flexible tool to examine drilling mud flow and optimize hydraulic parameters [7]. As a final result casing and drill string can be visualized (fig. 7).

4. Conclusions

1. Computer simulation can be effectively used for wellbore design.
2. Cooperation between management and engineers is necessary to reduce technical and technological problems.
3. One common database EDM helps to minimize mistakes in data exchange.
4. Landmark software is powerful tool which effectively reduces project design time.
5. Deep analysis of different casing and drilling scenarios shows danger field situations and makes possible to avoid many drilling complications.

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