In the coal industry, the broad development of coal extraction is taking place in dipping and slightly inclined deposits with a complex composition. The high rate of sinking and extraction operations in the Neryungra open-pit mine, for example, up to 20 m a year, predetermines the need for the intensive replenishment of mineral reserves in the system. The designation "reserves" here includes not only providing yields in a fixed volume but also creating conditions for controlling the quality of the coal extracted.

Preparation of the reserves in the group of deposits being considered has its own distinctive features, which define the organization of mining preparation work in a cut in a new horizon. The entire period of bringing the horizon into operation can be divided into several technological stages (TS's), which are distinguished by the growth volumes of the reserves and the working of the rock overburden (Fig. 1a). The technological stages are most clearly separated in running a cut trench in an extended manner—by single-layer downward stopes.

Initial Stage (TS0). In the prepared horizon and along each side of the open pit, a lead of overburden workings is created of size B0 sufficient for the beginning of work along the passage of the trench in the new horizon (Fig. 1a).

Stages Associated with Producing the Cut Trench (TSk, k = 1-7-K). At each subsequently executed stage, TS, the trench cut is deepened by an amount corresponding to sinking one stope (b). At the same time, at a size Bk, a removal area at the open-pit flank is produced, at which point bringing the trench cut to a fixed reference mark is possible, and at the last stage, to the mark for a new horizon. The set of the TS's providing horizon preparation are considered to be the technological period (TP) of development for the open-pit zone.

In Fig. 1a, a formal model of a pit flank is constructed for conditions of uniform replenishment of mineral reserves (URR). For visualization of stage formation, the sinking of the trench-cut stope was taken, considering that the development of each ledge in the TS was executed at a size which is a multiple of or equal to the width of the excavation stope A. It is evident from Fig. 1a that the initial stage of each TPj differs by an increased volume of overburden and by the fact that after the time of its development, no growth occurs in the reserves. At stages associated with the sinking of a trench cut, the reserves are prepared in the volume needed to provide uniform extraction of the mineral resource.

From the model presented for the formation of an open-pit flank, it is evident that, for the preparation of the reserves for TSj, it is necessary to work the overburden ledges (i) of the initial (\(\sum_1^i V_{i1}\)) and the first (\(\sum_1^i V_{i1}\)) stages, i.e.,

\[
\sum_{i=1}^1 V_{i1} + \sum_{i=1}^1 V_{i1} = V_j.
\]

In subsequent stages (k = 2, 3, ..., K), the uniform removal is carried out of overburden ledges at a value of \(B_k = A:\)

\[
V_k = \sum_{i=1}^1 V_{i1}.
\]
Fig. 1. Formation model of an open-pit flank (a) and graph of overburden-volume working (b), based on technological stages (TS_k) and periods (TP_j) for uniform replenishment of reserves in the system.

Fig. 2. Formation model for an open-pit flank (a) and dynamics of replenishing reserves (b), based on technological stages (TS_k) and periods (TP_j) for uniform movement of overburden operations.