# THE MAIN ASPECTS OF THE DURABILITY INCREASE OF HYDRO-TRANSPORTATION PIPELINE SYSTEMS PROVIDING EXPLOITATION RELIABILITY AND EFFICIENCY

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**Abstract:** Starting from the second half of the last century pressure pipeline hydro-transport systems saw wide scale development throughout the world. Nowadays their total length counts a few dozens of thousands of kilometers. These systems are effectively used in mining and construction fields, agriculture, hydraulic engineering construction, household sector, for long distance shipment of various solid minerals and construction material. This is mostly to be accounted for their economic effectiveness and ecological safety. This system significantly outranks the traditional types of transportation in all rates. It is very important that the system is easily implementable in any geographical and climatic conditions. In order to achieve high technical and economic indexes and for further widening of the sphere of utilization, this type of transportation requires timely and thorough study of certain issues.

There are large-scale studies ongoing in the Mining Institute of Georgia dedicated to the above objectives. The results of the studies so far achieved have gained to them the highest evaluations by the international scientific society. Despite the mentioned, hydro-transport systems need that certain works be performed for increasing their life time, reliability of operation and effectiveness. This is directly linked to the main factors: hydro abrasive wearing and dynamic processes of pipelines that appear to be totally different in hydro-transport systems. As it is of common knowledge, the carrying fluid mass contains a large amount of solid bulk material as well as the highly abrasive materials having different granulometric composition.

**Keywords:** hydro-transport systems; abrasive materials; hydro abrasive wearing; dynamic processes in pipelines.

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## 1. INTRODUCTION

There have been fundamental theoretical and experimental studies performed in the above mentioned institute toward hydro abrasive wear and dynamic processes, having used laboratory stands and main pipelines of large industrial hydro-transport systems with diameters 250-1400 mm (Makharadze et al., 2006; Makharadze and Kirmelashvili, 1986; Makharadze et al., 1984) used for transportation of different type, greatly varying from each other, highly abrasive solid bulk materials.

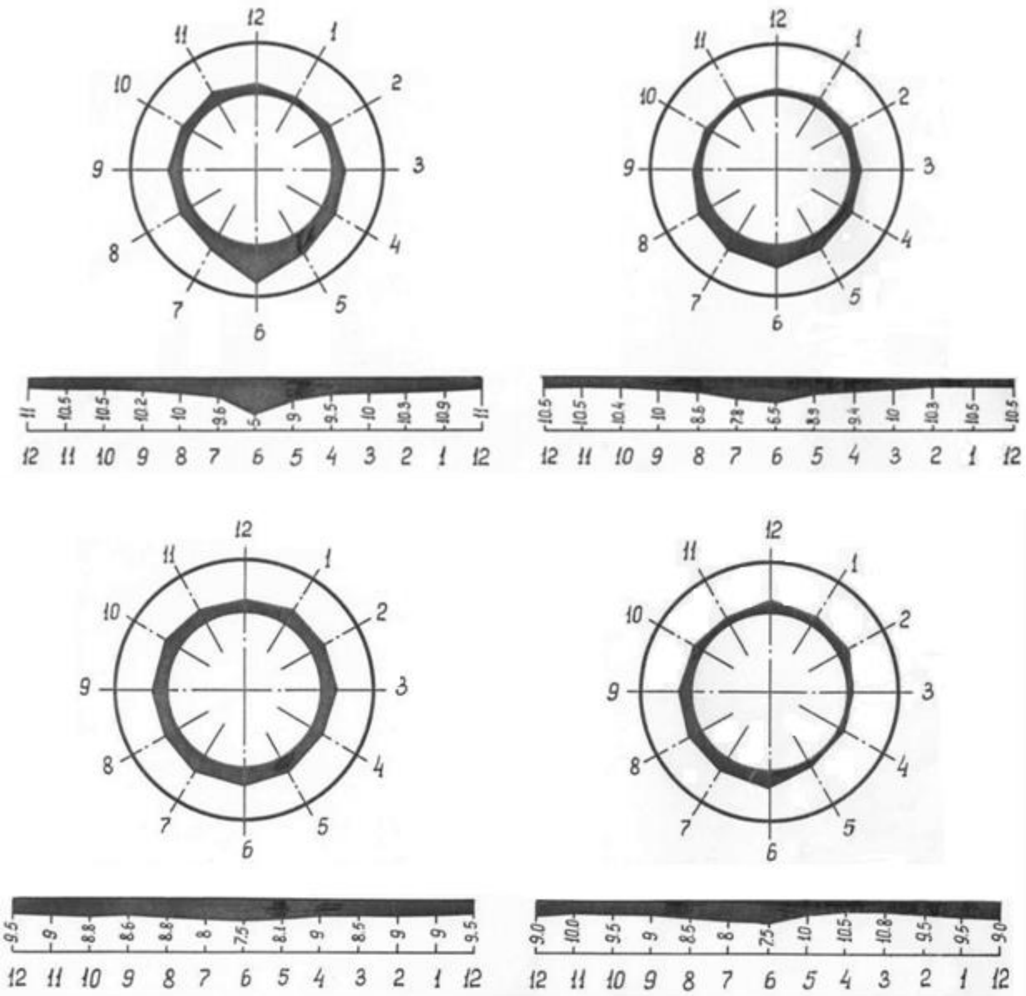


**Fig. 1.** Distributiondiagrams of hydroabrasive wear of hydrotransportsystem main pressure pipeline (*D*=426 mm) straight portion with slurry moving in them in various modes (with various parameters)

## 2. RESULTS AND DISCUSSION

The results of these studies are provided on figures 1 and 2 in the form of distribution diagrams for both the straight and curved portions (of turns) of the main pipeline. The analysis of these results enables us come to the following conclusions:

- Hydro-abrasive wear of main pipeline wall internal surfaces hold importance in any and all cases, therefore, it is unallowable to not give consideration to this factor in the methodology of calculating strength of pressure hydro-transport system main pipelines;
- Distribution diagram of hydro-abrasive wear of main pipeline varies in each case (is of different types), this meaning that thickness of main pipeline walls changes (decreases) following various regularities, this being ensued by the fact that it is practically impossible to maintain the established mode with the same indexes of parameters during the experimental studies even for short-time intervals. This is due to the fact that in the case reviewed concentration of the most important parameter – solid abrasive bulk material undergoes constant changes in carrying fluid material (water).
- Granulometric composition of the material, the shape of the solid bulk material particles and accordingly, abrasiveness and the level of abrasive impact on the main pipeline wall internal surface change constantly as well;

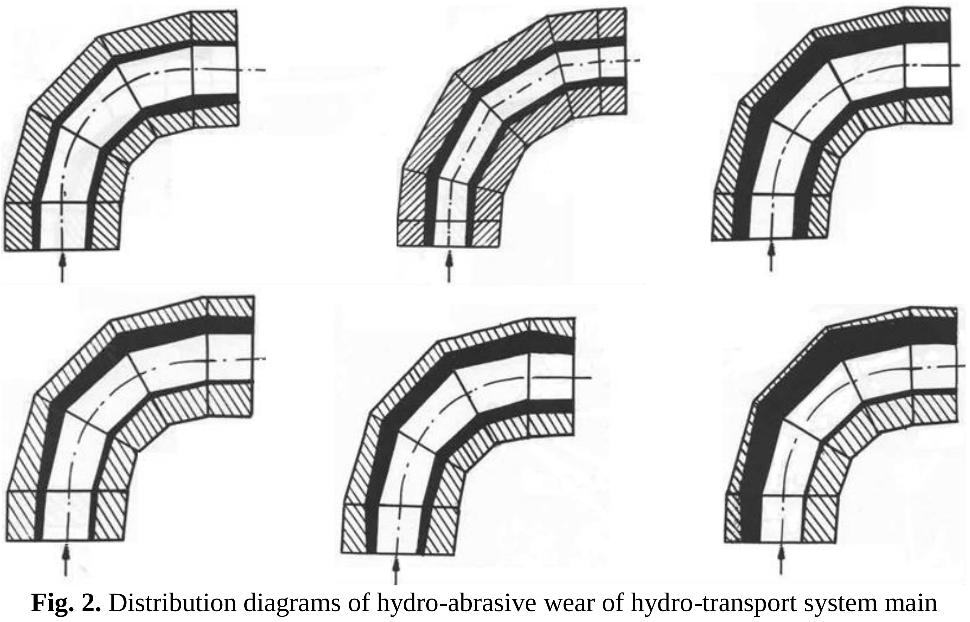

**Fig. 2.** Distribution diagrams of hydro-abrasive wear of hydro-transport system main pressure pipeline (D=426 mm) curvy portion (of turns) with slurry moving in them in various modes (with various parameters)

In uniform conditions hydro-abrasive wear of curvy (turn) portions of the main pipeline in more intensive than that of the straight portions (Figures 1 and 2).

Similar large-scale studies were performed to study changes of pressures during transitional modes and non-stationary processes in multi-stage hydro transport systems on laboratory and large industrial objects.

## 3. CONCLUSIONS

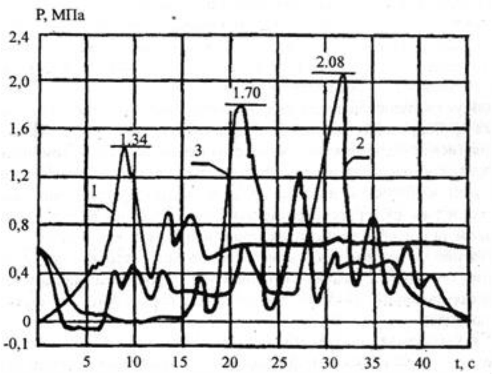


**Fig. 3.** Oscillograms of pressure changes in a 600 mm diameter main pipeline when 20P-11-type pumps are connected following the "pump in pump" scheme sequential circuit:
1 – when bringing them to operation;
2, 3 – when switching them off

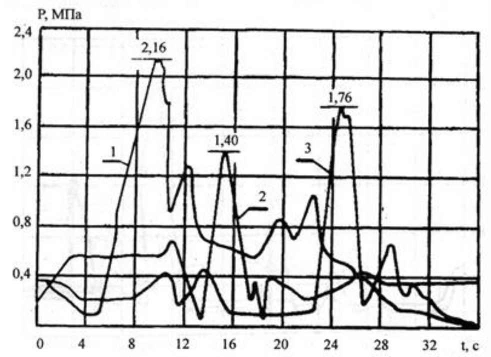


**Fig. 4.** Oscillograms of pressure changes in a 800 mm diameter main pipeline when 1000-80-type pumps are connected following the "pump in pump" scheme sequential circuit:
1 – when bringing them to operation;
2,3 – when switching them off

The studies revealed that at the time of bringing to operation and switching off the pumps in main hydro transport systems working without breaking the stream of centrifugal pumps connected to main pipeline following a sequential circuit the numerical values of pressure changes significantly exceed their indexes during the established mode (Figures 3 and 4), what negatively impacts the life cycle of the system as well as its reliability. Therefore, when designing similar systems, this factor should necessarily be given due consideration in the methodology of calculating the strengths of main pipelines.

## REFERENCES


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