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Short Communication

Survey on the causes of erosion and sediment in reservoirs of dams

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ABSTRACT

When a dam is built on the river, due to the accumulation of water in the reservoir speed river of input and increasing area of water flow is suddenly reduced. This decreases the carrying capacity of river sediment entering the reservoir and thereby settling sediment load in the lake behind the dam. In other words, regime change, the river, the water storage reservoir behind the dam also is converted to sediment accumulation. This is especially in arid and semi-arid vegetation without appropriate and surface water, with soil erosion, formed the Muddy River. Reservoir sedimentation rate of many of our country's is most worrying than the rate prediction. Though, this paper provides a brief overview of the different methods, sedimentation tank, as an appropriate method to find out the amount of sediment yield.

Keywords: Dams, erosion, sediment, sediment load, check the tank.

1-INTRODUCTION

Our country due to its geographic location and conditions is a semi-arid land, So that the average rainfall is less than a third of the average rainfall in the world. The uneven distribution of rainfall in time and space also adds to the problems of water utilization. With a glance at the statistics shows that the bulk of its rainfall occur in the coastal areas of the Caspian Sea and the Northwest Territories and the West of the country, while a large part of Central and East regions of the country are covered by plains and arid deserts. The rains often occur in times of need was lower ,especially in the agricultural sector, the agricultural season that is in dire need of water, less precipitation occurs. Surface water flow is also due to spatial and temporal heterogeneity of rainfall, for non-uniformity is distributed throughout the country. According to the above reasons inhibition and optimal utilization of the waters is crucial, and in this regard build dams to store surface water in low season and adopting it widely used in seasons is one of the primary ways. But it does not end there. For example, White River Lake Dam with an initial capacity of 8.1 billion cubic meters, only after three decades of dam construction fell to about half of this amount.

Sediment accumulation in reservoirs in addition to reducing their water storage capacity for agricultural purposes, industrial, drinking and, control flood also to reduce them. The result can be financial and even physical consequences .So be sure to have sufficient knowledge of the deposition catchment dams upstream before building. The deposition watershed is one of the main hydrological characteristics. A common way to meet it, is that after estimating suspended sediment load hydrological methods (Combination of

continuity of flow and sediment rating curves), because of the scientific and practical limitations in identifying and measuring the floor, It experimentally and to reform the expert view are suspended percent of the time. This is not always true, but often cause significant errors in estimating the total amount deposited because, according to UNESCO (1985) percentage (floor load sediment) is generally from 3.0 to 1300 percent changes and while it usually takes between 15 and 30 percent. The already difficult was in estimating the floor load and the estimated time wasnot suspended. But recent research WALLING and Webb (1981) shows that the procedures of the suspended load with errors are usually lower than the actual estimate.

Generally, the use of reservoir sediment is considered as a good way to understand the deposition basin and the results of its field has the following goals and advantages:

1. Determine the more realistic deposition of area includes Suspended load and floor load wash load and load of floor materials.
2. Determination of new capacity tank and incorporate it in dewatering operations.
3- Understanding the distribution of sediment in the tank
4. By Examining layered deposits of delta flooding areas and the return period is detectable.
5. Information on the quality and quantity of sediments can be deposited for recycling operations and used tank volume
6. The data obtained can be used to plan and carry out other tanks.
7. The results of the impact assessment and the scope of protection.
8. The projected useful life of the tank.
9. Awareness of the erosion rate ranging from surface erosion.
10. Awareness of the erosion rate in the area for longer periods of time.
11. No need for general statistics about the erosion and sediment transport models or spatial extrapolation from local measurements.
12. The data collected in the survey range from small tanks (tank range) done.
13. No need to continuously measure water and sediment samples to determine the concentration, especially in flood seasons that these measurements are more difficult and sometimes impossible.
14. Many tanks come in a variety of branches and departments that are not part of hydrometric stations, with this method of all branches of sediment are assessed.
15. The method allows the measurement of sediment through erosion of the middle area and are around the dam (after measuring stations) are deposited in the reservoir there.
16. In this way in a short time span allowing sediment is possible and does not need Hydrometric years of measurement stations.

In summary, due to the information sedimentation tank, tank sediments from anywhere and in any way are left, appointed in a small span of time and place.

Sediment in river engineering refers to particles by water flow in the canal or river, no matter its size, is carried or deposited. Or sedimentary material called sediment load carried by the river's flow.

What is causing sediment is erosion. In general, the process is called erosion in which soil particles are separated from their original context and help to carry out a transfer to another location.

Deposition said to exiting of sediment from an area at certain period is in which is measurable at its certain point.

2. Sediment transport

The second stage of the process of erosion is Sediment transport. At this stage, erosion sediment particles separated from the area by various factors (eg, physical, chemical and biological) transfer by different factors (such as water, wind, ice and waves) is moved from their original location to other places. Because of the various factors, water is all the more active paid to water erosion.

Surface runoff from precipitation on the area in addition to erosion and wash the surface soils, transform them into the drainage field. By transferring the flow of water in rivers, soils

washed downstream, stream floor material into the catcher moves.

The transmission mechanism, sediment load is divided into two categories:

A) Suspended load

B) Bed load

Planning suspended load consists sediment particles that are suspended in the main body of flow and moves speed roughly equivalent to the flow rate.

To deteriorate in large sedimentary particles that slip in different ways, distracted of and bound near the waterways and are constantly in contact with it.

In general it can be said that the above classification is based on the size and turbulence. Based on clay and fine silt, and most likely always will be suspended for, and sand and gravel transport as bed load. While sand particles depending on the volatility of energy flow may be suspended load or load various parts of the bed, or even to move anyway. In terms of sources and the origin of the sediment load are in two kinds

A) Bed material load

B) Washed load

Bed material load consists of sediment material streams derived from the body and moves in the direction of flow.

Washed load consists of sediment particles rolling load caused by rainfall and the area washed into the waterways, and without sedimentation of waterways to natural or artificial reservoirs will be transferred.

Washed load always move suspended but included of suspend load and bed load and also 10%of diagonal on of particles smaller waterways consider as once washed.

Suspended sediment 0.0625mm diameter less than their concentration does not change the depth of the sediment in diameter, depending on the depth, their concentration is different (their concentration increases with increasing depth).

Some sources 0.0625 mm diagonal boundary line between sediment load and bed material load is washed once have mentioned, but according to some observations have proven that this claim is not always true For example Poplawski et al (1989) observed that the smaller the particle diameter of 0.15 mm in the ingredients there are no Australian Flinders river bed, while more than 85% of particles suspended in the load takes over. Therefore, in this study of 0.15mm diameter as the border area of suspended load (load washed) and stream sediments (context load) is known.

According to studies of Mizuyama and Watanabe (1981) studied in both Japan (Sumiyoshi basins and Kizu) diameter of 1.0 mm as the boundary between the bed material load and the wash load was detected.

3. The methods used to estimate sedimentation basin

Analytical methods for deposition in the basin are divided into two categories:

A) Measuring deposition

B) Deposition Forecast

Measuring deposition:

- Sediment sampling
- Study tanks

Forecast deposition:

• Assess the factors affecting the deposition

• Evaluation of the gross erosion rate equation

• Application of Sediment transport equations

• Empirical equations derived from measurements

• Mathematical models

3.1 Measuring deposition

Direct measurement of deposition as the most reliable method to determine the deposition area considered. This work, will be investigatedby sampling sediment load in rivers or reservoirs

3-1-1- sediment sampling

The river sediment sampling, collecting enough samples for suspended load or bed load sediment transport in order to determine the total transferred sediment. It is also imperative that at the time of sampling, flow rate will be measured.

The main objective of suspended sediment sampling program is to determine sediment discharge and suspended sediment curve This is often done by plotting the log of the curve

usually water flow rate (m3 / s) Qw in the sediment load Qs (in ton / day).

Suspended sediment rating curves can be combined with the data flow, sedimentation basin to determine the long-term average. Certainly longer period's statistically more reliable results are obtained. One of the techniques available for data measurement stations that cover a long period is the daily flow duration curve of water flow. The cumulative frequency curve charts shows the percentage specified when rates are equal to or less than a certain amount for the period under study.

In addition to the time domain analysis of the deposition of a bed load sediment should also be considered. Three common methods used to determine the share of bed load

(1) Apply a correction based on the percentage of suspended load

(2) Special sampling field for use in one or more trusted bed load transport equation

(3) Sampling using a sample bed chucks appropriate time.

3-1-2- checking the tanks

Measurement of sediment accumulated in the reservoir by many experts as the best method to determine the sediment basin is considered. Review existing reservoirs for the storage and distribution of sediments accumulated in their decline, useful data on deposition rates also differ by area and also provided for the purposes of exploitation

3.2 Forecast deposition

Most forecasting methods deposition basin directly or indirectly based on the results of the measurements of deposition or relies on sediment sampling survey tanks. The method or methods used to predict the deposition to a certain extent by the experts to evaluate sediment after field visits and review of all available data, it depends.

In some cases, one or more of the different methods of prediction of deposition, to places where direct measurement is not possible (either in time or in terms of cost) may be used. They chose to study the details of that, the cost of design, usability and reliability of the method depends on the specific area.

3.2.1 Assess the 9 factors affecting deposition

This method is a significant amount of judgment and experience in relation to the factors affecting the erosion and sediment transport needs of an area. The basic problem of a field visit by experts to assess risk factors and sediment deposition is rate (in ton / km / year) .They often do this by comparing the erosion and sediment production in other similar areas of the practical measures they have taken (or check sampling tanks) are doing.

Nine factors affecting erosion and deposition are as follows:

- The amount and intensity of rainfall -the type of soil and geologic information
- Land cover - land use
- Topography - high erosion or runoff erosion History
- The deposition - Hydraulic drainage basin

3-2-2- Evaluation gross erosion rate equations

General equation of soil loss (universal equation of soil erosion by USLE) is widely used around the world to determine the gross erosion rate. This equation is based on regression analysis of erosion in some parts of the United States has been obtained. Some kind of linear regression models have been developed to simplify the USLE. An empirical method combined gross erosion rate of transmission (delivery) deposition was developed by Jansen and Painter.

Overall USLE equation is: A = RKLSCP

In which:

A = soil loss (in (ton / acre / year R = rainfall factor

K = K-factor L = slope length factor

S = slope of the intensity factor (LS = Topographic factor) C = factor crop management,

P = factor conservation (erosion control)

The rate of erosion of arable land can be estimated by the equation. But it should be noted that since this equation has been obtained for some parts of the United States, thus cannot

be directly used without further studies on the rest of the world.

3.2.3 The use of Sediment transport equations

Many equations substrate materials can be used as a rough estimate used in predicting the deposition area. This method is particularly applicable when the bed material load in the river sediments have the major share of the total, in other words, smaller materials such as clay, silt particles (diameter less than 0.0625mm) in structural design is not important. This reservoir (small), in which smaller particles remain suspended until the 0.0625mm by evacuations precipitated out, is true. All bed load transport equations including Meyer-Peter and Muller (1948), Schoklitsch (1935), Ackers and White (1973), Pemberton (1972), Engelund and Hansen (1967) and Yang (1973) can be used to predict Handling bed material load.

Data required for the application of these equations are other similar examples taken from the bed materials of the river cross sections and mapping. The next step is the calculation of bed load sediment curve using data obtained from the equation of any known flow rate and flow duration curve can be used in combination with long-term average precipitation for the area defined substrate material.

3-2-4- empirical relationships according to measurements

A very simple and reliable, in many cases, predicted deposition area is measuring according to the empirical formula. This method requires the least amount of data provided by an expert sediment properly assessed, to significantly reduce the project cost. In this evaluation, measurement data is extrapolated basis to provide domain-similar. In this way the data can be found in the same area (with erosion and sediment runoff characteristics similar) to predict the amount of precipitation.

In this regard, there are two common approaches:

1) Deposition using a domain directly to another

2) The use of deposition field by applying a correction factor equal to the ratio of discharge

Another way to predict sediment deposition involves the development of a relationship in terms of area, which obtained measurements carried out. And it can be used in the same areas with erosion or Sediment transport characteristics. This method can be used as testing other methods or used as a rough estimate. Comparison between deposition agents in the application of this method is very important.

3-2-5- mathematical models

In this model, most of the nine factors of erosion is used. They must prove the accuracy of measurements. Compare areas studied using a model-dependent areas of the model that has been tested. The fact that the model can be directly applied to a field depends on the decision of professional's sediment.

4. Evaluation of deposition estimates

It can be argued that all methods of deposition estimates are based on three main methods: 1) Hydraulic methods 2) hydrological methods and 3) sediment tanks

4.1 hydraulic methods

According to experts, including sediment and Yang (1994) Hydraulic methods of Sediment stream includes three categories:

• Suspended load estimation methods
• Methods to Evaluate the Bed
• Methods used to estimate the total load

Of course, each of them was a detailed discussion beyond this article. Here is just a general assessment of Hydraulic paid.

In this regard Habibi (1995) stated that almost all the sediment transport formulas (such as Einstein (1955), Engelund and Hansen (1967), Ackers and White (1973), Yang (1973) and Van Rijn (1984)) that as functions of time Hydraulic flow characteristics are obtained, only able to calculate the rate of stream sediment transport (context load) and ability to predict sediment load area (once washed).

In the case of hydraulic formulas for calculating the context, Lan and Borland (1951) stated that in the estimation of bed load rate many factors that must be considered and they do not in general be a simple rule or formula to obtain small quantities at all rivers found.

ShafaiBajestan (1994) and Julien (1995) stated that time Hydraulic connection is available to calculate the sediment load, the maximum transmission capacity to estimate river, the river may not provide this value. So the actual discharge measurement will be much lower than the amount calculated by this formula.

Njmayy (1989) stated that the application of theoretical formulas (hydraulic) in rivers cannot be done with full confidence. This is due to the complexity of the issues sediment and mismatch theory and practical issues in Sediment transport are assumptions. One of the major problems that the use of these structures was observed, determining the values of the various factors that are mentioned in formulas. In addition, it's clear that these coefficients are just variables or not, so many studies and efforts needed to scrutiny factors and how to use them. Also in using of either formula should be carefully studied whether formula is justified by the river or not.

Yang (1996) by comparing and evaluating Sediment transport functions (formulas Hydraulic) stated that most of these methods for engineering applications are very complex. Many of the parameters used were based on limited observations, simplifying assumptions used in their laboratory in comparison to complexity theory has been used in these methods, were not very accurate. It also requires large amounts of field data, which in many cases are not available, limit the use of these methods for solving engineering problems. ICOLD (1983) also used in the formulation, simplifying assumptions (eg constant size bed material to flow changes) that are the critical, pointed out. Hassan Zadeh (1998) pointed to an important point about this formula that is all existing formulas have been established based on the assumption of a constant flow of bed in equilibrium (regime). Therefore, the results obtained from the use of empirical formulas have been very different and river engineering problems with non-permanent and non-uniformstudents (and of course lodge imbalance), recommending particularformula isvery difficult

4.2 Hydrological methods

These methods are based on actual measurements according to samples taken from streams in the field and statistics are derived from these measurements. In total measurement by sampling sediment into three categories:

• Measurement of suspended load
• Measurement of bed load
• Measuring the total load

According to the explanation of each of the above in addition to being time-consuming, is outside the scope of this article, this issue is addressed only to the overall assessment.

Masjedi (1997) stated that the measure sediment transport in Hydrometry stations (with compound curves discharge - discharge and sediment curve) obtained by trade, is not very reliable, particularly if short period and distribution of the diagram discharge - too much sediment. Due to the fact that most of the sediment Flood with transfers, only measurement is not enough to rely on annual average. The sampling of bed load was very difficult and mainly is calculated by Hydraulic formula.

Duck and McManus (1994) also recommends the use of the sediment study, reported that direct measurement of bed load and long-term problem is rarely the result of sampling into the river as well as data is not accurate. In addition, said the plan does not exceed a few years of sampling are often used to determine the spatial and temporal distribution of sediment movement fail. Especially in the mountain river bed load is very variable high as well as many practical problems for field measurements there.

Due to technical problems and constraints mentioned as bed load measurement accuracy is not scientific, so experts proportion of suspended load as bed load is considered, that

due to the wide range of time changes of bed load the result not be properly.

Comparison to the bed load suspended load assumed and observed in the world, some examples to be mentioned:

- Bahadari Khosroshahi (1995) reported that experts in Iran consider the bed load tosuspended load ratio of 15 to 30 percent
- Njmayy (1989) noted that the ratio of five to 25 percent.
- Alizadeh (1995) it is stated that 10 to 50 percent.
- Refahi(1996), the ratio of between 10 to 50% and 20% by volume usually cited.

Yang- (1996), this amount is generally from five to 25 percent cited.

The numbers do not stop there, according to various studies, some researchers have reported different figures:

- Kardashev ratio for Russia in rivers with a slope of more than two per cent of 50 to 300 percent and for less than two percent slope between one and five percent stated.
- Sheppard, according to the ratio between zero and 100% respectively.
- According to UNESCO (1985) this ratio varies from 3.0 to 1,300 percent.

Even sediment as well (which is the basis for calculating the bed load by applying the above factors) still cannot be measured accurately. Especially during large floods, most sediment is moving at the time. Although the suspended load with more accuracy than the load bed load is measurable.

In this regard Arabkhedri and colleagues (1998) conducted a study on the river in the area of the lake, showed that by applying different statistical methods on the same data, the results for suspended load transported to has several times differences.

4-3 **sediment tanks**

As we have seen each of the previous methods to estimate the burden of stream sediment deposition area or have bugs (sometimes major) and in the abstract is not to be trusted either, unless their validity has already been approved by an accurate measure of or the so-called are calibrated (calibration).

The volume of sediment accumulated in the reservoir to determine the potential scope of the upstream sediment are very valid, and determine by the depth determination, which today's is popular everywhere, so that after the dam construction data sediments accumulated in the reservoir provides data and other information in the development of sediment production are used. The data obtained from this study will be to determine the new capacity tank and tank filling operations of them. As well as other information such as the distribution of sediment in the reservoir tank and the main stream flow changes as a result of transportation and deposition of sediments obtained. Data obtained from field studies during the study data of sediment density, particle size distribution, the amount of sediment accumulated in the reservoir, sedimentation coefficient transient (trap efficiency) in the tank and flows thick.

ICOLD (1983) also reported that information in addition to data about the reservoir sediment deposition also provides information for the purposes of exploitation.

Rausch and Heinemann (1984) study of sedimentation tanks to measure the stated area as a most excellent way. The results of tanks estimate the rate of erosion of the surface area of erosion forms (washed twice) sediments from rivers flow (context load) and for longer periods of time in various areas gives

In addition, Stott and colleagues (1988) say that because the measure sedimentary deposits based on statistical methods of spatial extrapolation of erosion and sediment transport or local measurements are, in principle, are very useful and decisive.

The relative simplicity of data collection in the study of tanks compared to samples or measurements of surface flows is an interesting point, because only a very small area is carried out.

Bruk (1985) a total of determining the amount of sediment that has accumulated over a specific period of storage tank life goals and the results reported.

• Estimation of sedimentation basin

• Evaluation of erosion basin
• provide data needed for the design and implementation of other tanks
• Evaluation of the results of protective measures in the field of
• The distribution of sediments in the reservoir under study
• Prediction of the useful life of the tank.

Reynolds (1986) stated that the collection of data on sediment accumulated behind the dams or ponds semi-permanently installed in the river, a more reliable estimate of the deposition area will obtain.

In addition, Duck and McManus (1994) stated that by analyzing the delta sediment layers can be events related to floods in the area as well as the return periods of bed load transport layers detected. It also provides information on the quality and quantity of sediment deposited can be used for recycling volume.

BahadariKhosroshahi (1995) as well as terminals suitable reservoirs for trapping and accumulation of sediment is considered, the sediments accumulated in the tanks of the total load carried by rivers In which bed load and suspended load both have intervention. In a sense, the results of hydrographic and volume of sediment deposited in reservoirs can be considered as the figures observed and calculated values of sediment loads to be compared with it. Masjedi (1997) the benefits of mapping reservoirs compared to other methods are as follows:

- The sediment bed load and suspended load in the tank or in the form of the measurement.
- Need to continuously measure water and sediment samples to determine the concentration is not particularly seasonal flood that these measurements more difficult and sometimes impossible.
- A lot of tanks into several branches that are mostly not Hydrometry station. For example, the total branches Lavarak,Afje,NaroonGlndvk and Lashgarak Latyan lead to Latyan reservoir, only Lashgarak river has Hydrometry station while the other branches, especially in the flooding, sedimentation tank is significant. In this way, the sediment input from all branches of measurement is entered.
- This method allows the measurement of sediment through erosion of the middle area, and the area around the dam reservoir is deposited there.

In other words, using hydrography, sediment from anywhere and in any way to enter the tank and place to stay, to be measured. In addition, the deposition material, compression and accumulation over time, the amount of recycled or occupied and the evolution of the delta front deposits in relation to dams and drainage channels are fully recognized. In addition, in a shorter time period (relative to the statistical methods), sediment is possible and requires many years of measuring stations Hydrometry input and output (even if there is such stations) is not.

The qualitative portion also includes maps of the deposits offered in any area of the reservoirs that can certainly be used in decision-making, particularly in relation Balmkan drain reservoirs of sediments, and the force direction are movement of emotional, or a avulsion again and sediment.

This method, however, due to equipment limitations in terms of their high cost and the need for skilled manpower have efficient problems, But given the short time operations per period of 5 years is that, compared with other types of problems as well as positive results of the procedure that has led to today has been widely all over the world common is ignorable.

5. CONCLUSION

It is recommended that other deposition methods to estimate sediment tank are calibrated and they should be used.

Cut deeply disturbed and undisturbed samples to be examined from tank depositsthis aggregation and deposition of the designated weight for a more accurate estimation and there is no need for experimental methods and analysis.

In addition to sediment hydrometric stations. Grading also is determined in this way a better

understanding of the sediment deposits in the reservoir created by the aggregation precise amount of suspended sediment load, resulting in bed will be achieved. To understand better the processes involved in sediment deposition in the reservoir tank facilities for this work to a maximum period of five years to accomplish each tank. Finally, on the advice of Rauch and Heinemann (1984) for a detailed assessment of sediment upstream areas, should be ensured that contain at least one of the following two prerequisites:

A) The tank should be isolated from their constituencies to act as terminals all deposits, or

B) The amount of sediment in the tank should be in access.

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