Sedimentation tank design example pdf

Sign in to Constructor to ask questions, answer questions, write articles and connect with other people. VIP members have additional benefits. Do you have a receipt? Sign in To sign in to Constructor to ask questions, answer questions, write articles and connect with other people. VIP members have additional benefits. Do you have a receipt? Sign In This book is designed to serve as a comprehensive source of information of sedimentation processes and design of settling systems, especially as applied to the design of such systems in civil and environmental engineering. The book begins with an introduction to sedimentation as a whole and goes on to cover the development and details of various settlement theories. The book follows the chronological development of comprehensive knowledge of the settlements of studies and the design of settlement systems from 1889. A complete pipe alignment theory has been developed and its use in calculating remaining solids from assorted solids has been demonstrated through the same. An experimental examination of the pipe alignment theory was also presented. The field-oriented compatible design and methodology of operation of the settlement system was developed from a detailed study of the correct settlement system. There seems to be a new parameter for aligning comparisons of performance justice for its purpose. The methodology for designing high-level systems for alignment with a disasued case has been presented and flexibility of operational control has been demonstrated. Finally, along with presenting all thickener design theories has solved the same thickening problem with all methods to reveal differences in designed hashing. The content of this book will also be useful to students, researchers and professional engineers. Construction Hydraulics Jar Testing Sedimentation System Settlement Systems Thickening Tank Thickening Pipes Settlement Wastewater Treatment Purpose settlementPrinciple types settlement Type I settlementTipi settlement Tanks Inlet and Outlet Arangement Weir Overflow RatesSettling Operations Settling Solid liquid separation process in which a suspension is separated two phases Clarified – supernatant the leaving top of the sedimentation tank (overflow). Concentrated sludge leaking the bottom of the sedimentation tank (dressing). Purpose of action For the removal of a large dispersed phase. For the removal of coagulated and floculation impurities. To remove precipitation impurities after chemical treatment. To align the sludge (biomass) after the activated procedure of sludge /tricking filters. The principle of settling suspended solids present in water with a specific gravity greater than the gravity of the water shall be embodied after gravity as soon as the turbulence settles down with the supply of storage. Pool in which the current is retarded It is called a alignment tank. The theoretical average time for which water is retained in the reservoir is called the detention period. Type of alignment Type I: Discrete particle alignment - Particles are settling individually without interacting with adjacent particles. Type II: Flokulent particles – Floculation causes particles to increase in mass and to rest more quickly. Type III: Obstructed or zone alignment – The particulate mass is loaded as a unit with individual particles remaining in fixed positions to each other. Type IV: Compression – The particle concentration is so high that sedimentation can only occur by condensing the structure. Type I AlignMent The size, shape and specific gravity of the particles do not change over time. The alignment rate remains constant. If the partier is suspended in water, initially has two forces acting on them: (1) gravity force: Fg=rpgVp (2) a tube force quantified by Archimedes as: Fb=rgVp If the density of the particuous differs from the density of the water, the net force is executed and the garlic is determined in the direction of force: Fnet=(rp-r)g This net force becomes the driving force. When a proposal is started, a third force is created because of the viskostic friction. This force, called the pull force, is quantified by: Fd=CDAprv2/2 CD= drag coefficient. Ap = partior project area. Since the pull force works in the opposite direction with the driving force and increases as a square of speed, the alacitation is dogadja snication, Until the calm speed of the hip is reached, the impact of the push is equal to the driving force:(rp-r)gVp = CDAprv2/2 For spherical cisce,Vp=pd3/6 i Ap=pd2/4 So, v2= 4g(rp-r)d 3 CDr Expressions CD for change with characteristics of different flow regimes. For laminar, transition and turbulent flow, Cd values are: CD = 24 (laminar) Re CD= 24 + 3 +0.34 (transition) Re1/2 CD= 0,4 (turbulent) in what is Re Reynolds number: Re=rvd m Reynolds number manja from 1.0 to the label of laminator current, while values greater than 10 mark turbulent current. Intermediate values indicate transient flow. Stokes Flow For laminar flow becomes the equation of the speed of the settlement terminal: v= (rp-r)gd2 18m, which is known as the Stokes equation. Transition flow To solve no linear equations: v2= 4g(rp-r)d 3 CDr CD= 24 + 3 +0,34 Re Re1/2 Re=rvd m Calculate speed using stokes law or turbulent expression. Calculate and check Reynolds' number. Calculate the CD. Use a general formula. Repeat from step 2 to convergence. Types of reservoirs for the settling of removal tanks may operate either interrupted or continuous. Intermediate tanks, also called tanks for still types, are those which store water for a certain period of time and keep it to rest. In the continuous flow tank, the flow rate is only reduced and the water does not lead to full rest, as is done in the intermediate type. The alignment of the pools may be long perpendicular or in the plan. Long narrow rectangular horizontal current tanks are generally preferred to circular tanks with radial or spiral flow. Long rectangular alignment basin Long rectangular pools are more hydraulically stable, with this configuration making it easier to control the flow rate for large volumes. A typical long rectangular container has a length of 2 to 4 times the width. The bottom is slightly tilted to facilitate the scraping of the mud. The slow-moving mechanical mud scraper is constantly pulling the settled material into the hopper mud, from where it is periodically pumped. The long rectangular reservoir can be divided into four different functional areas: Inlet area: A region in which the flow is evenly distributed across the cross-section so that the flow through the handling area follows a horizontal path. Area of conduct: Settlement occurs under calm conditions. Exit area: The cleared outlet is collected and released through the weir socket. Sludge area: To collect mud under the alignment area. In-douty and drainage installations: In-do planes shall be designed to distribute water evenly and evenly. A line should be built in a pool close to the inlet which should be projected several metres below the surface of the water in order to break down the inflow speeds and ensure a uniform flow; Output devices: Output devices or submerged apertures shall be so designed as to maintain speeds suitable for pooling and to reduce short circuits. Weirs must be adjustable and at least equivalent to the length at the perimeter of the tank. However, peripheral bears are not acceptable as they cause an excessively short circuit. Weir Overflow Rates Large flow rates of freaks cause excessive speeds at the exit. These speeds extend back into the alignment area, causing particles and flocks to be dragged into the socket. Weir loading is generally used up to 300 m3/d/m. It may be necessary to provide specific weir models on board, as shown to reduce the level of the weirdo dressing. Aboard weir arrangements to increase the weir length of the circular basin Circular basins have the same functional zones as the long rectangular basin, but the flow regime is different. When the current enters the center and is passed off to flow radially towards the perimeter, the horizontal water speed is constantly decreasing as the distance from the centre increases. Thus, the partial runway in the circular parabola basin is at odds with a straight line in a long rectangular tank. The mechanisms for removing sludge in circular tanks are simpler and require less maintenance. Alignment operations Parts falling through the alignment basin have two components of the speed: 1) Vertical component: vt=(rp-r)gd2 18m 2) Horizontal component: vh=Q/A The partient path is made with the vector sum of the horizontal vh speed and the vertical alignment rate vt. Assume that the alignment column is broken in the sort area flow and that the column is flow through the area of the handling. Note the particle in the type 1 alignment series analysis, which was initially on the surface and aligned through the depth of the Z0 column, at the time of t0. If the t0 also corresponds to the time required to horizontally transfer the column over the alignment area, the fragment will fall into the sludge area and remove it from the suspension at the point where the column reaches the end of the alignment area. All particles with vt>v0 will be removed from the suspension at some point along the area. Think about the particue at < v0. If the initial depth of this partier was such that Zp/vt=t0 is such that this fragment will also be removed. Therefore, the removal of suspended particles passing through the alignment area will be in proportion to the ratio between the individual alignment speeds and the alignment rate v0. The time t0 corresponds to the retention time in the alignment area. t= V = LZ0W Q Q Also, t0= Z0 v0 Therefore, Z0 = LZ0W and v0= Q v0 Q LW or v0= Q AS Thus, the depth of the pool is not a factor in determining the particle size that can be completely removed in the settlement area. The determination factor is the quantity of Q/As that has speed units called gradient rate q0. This overflow level is a pool alignment design factor and corresponds to the rate of the partifier terminal setting, which is 100% removed. Design Details Detention period: for ordinary sedimentation: 3 to 4 h, and for coagulation of sedimentation: 2 to 2.5 h. Flow rate: not more than 30 cm/min (horizontal current). Tank dimensions: L:B = 3 to 5:1. In general L= 30 m (total) maximum 100 m. Depth 2.5 to 5.0 m (3 m). Surface spill-over rate: for normal sedimentation 12000 to 18000 L/d/m2 of the surface area of the tank; for thoroughly flocced water from 24000 to 30000 L/d/m2 of the tank surface. Slopes: Rectangular 1% towards the inlet and circular 8%. Example of a case created