

# Grit System Design Info

## Cut-Points, Gradation, and Settling Behavior

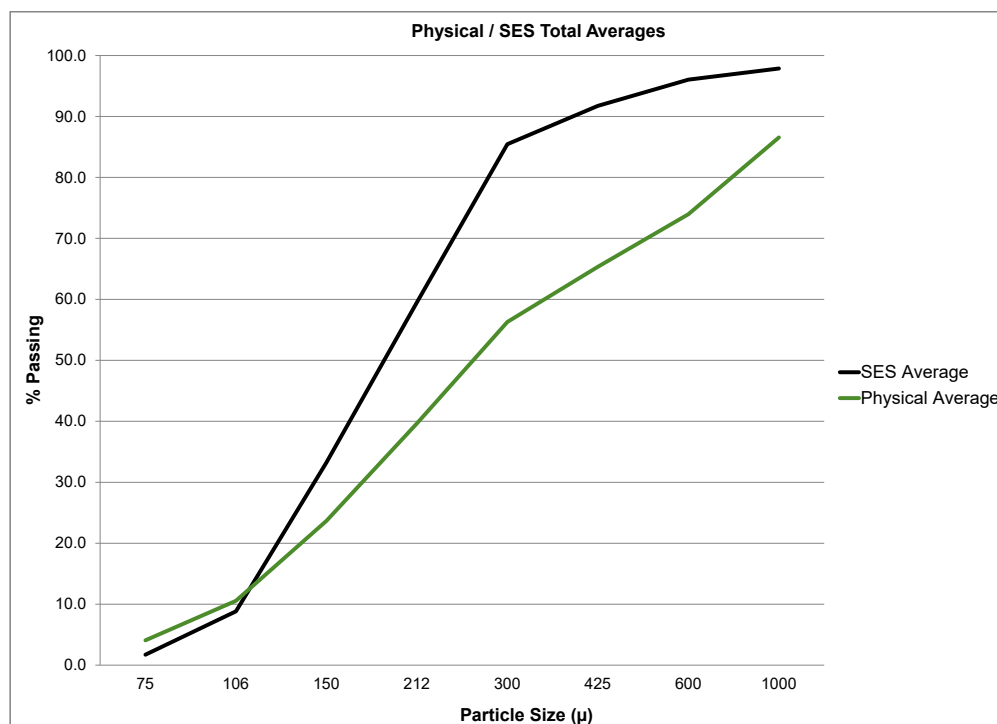
Aggregate data from hundreds of on-site grit studies at plants throughout North America.

### Physical Size vs. SES

Many grit systems are designed assuming all grit particles are spheres of silica sand with 2.65 SG. Ideal assumptions rarely apply to wastewater. Designing the grit removal system for fine particle removal and considering settling velocity gives a true sense of expected removal efficiency.

Sand Equivalent Size (SES) is the size of a sand sphere having the same settling velocity as the collected grit fraction. It is not uncommon for large grit particles, 300 micron ( $\mu\text{m}$ ) and larger to settle as though they are a much smaller particle. SES normalizes the particle cut point size back to the settling velocity of a clean sphere of silica sand providing a known design point for grit system design.

Most conventional grit removal technologies target a particle size of 212-300  $\mu\text{m}$ . But on average, roughly 56% of grit entering wastewater treatment plants is smaller than 300  $\mu\text{m}$  while almost 40% of grit entering the wastewater treatment plant is smaller than 212  $\mu\text{m}$ .



% Passing								
Micron	75	106	150	212	300	425	600	1000
National Average Physical Size	4.1	10.5	23.5	39.4	55.9	65.0	73.6	86.3
National Average Settling Velocity	1.7	8.8	33.0	59.1	85.2	91.5	95.9	97.8

Using settling behavior, even less of the grit settles as though it is a 300 or 212  $\mu\text{m}$  particle. Nearly 60% of grit entering wastewater treatment plants settles as though it is a smaller particle than 212  $\mu\text{m}$ . This insight provides clarification why the physical size criteria does not provide a sufficient design basis to protect the plant from abrasive wear and deposition.

### Optimal Design Cut-Point

In this data, it can be seen that the physical size and settling velocity curves converge in the 75 to 150  $\mu\text{m}$  range, often near 106  $\mu\text{m}$ . This, along with the settling velocity gradations, indicates this is the optimal design range for effective grit removal. As accurate grit reference data is not readily accessible, it is frequently unavailable for consideration during the grit system design process. Grit systems designed to remove grit particles 106  $\mu\text{m}$  and larger generally remove 85-95% of all grit entering the plant.

## Gradations and Settling Data

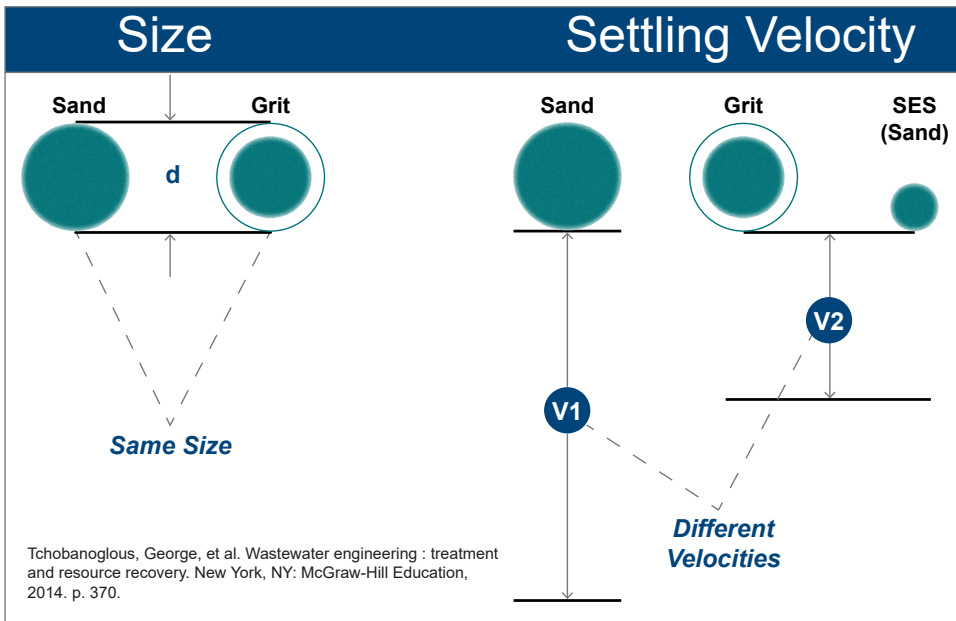
Even more rare is settling velocity data. To assist with the design process Hydro offers our continually growing database of regional gradation and settling behavior data to Engineers and Municipalities. We welcome the opportunity to share this valuable data with our clients. Data is available for the regions shown in the table to the right.

State data is available for individual states where more than 5 data points are available; those states currently include Georgia, Texas, Florida and Virginia. Regional gradations are shown below.

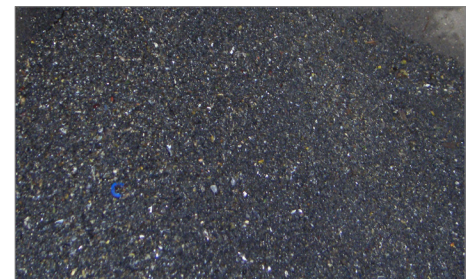
Region	States Included
Mid Atlantic (MA)	PA, NJ, MD, DE, DC, VA, WV
North Central (NC)	MO, KS, KY, IN, OH, IL, MI, WI, IA, MN, ND, SD, NE
North East (NE)	ME, VT, NH, MA, RI, NY, CT
South Central (SC)	TN, AR, OK, TX, LA
South East (SE)	NC, SC, GA, AL, FL, MS
Western Canada (W CN)	AB, BC, MB, SK
Western US (West)	WA, OR, CA, AK, HI, AZ, NV, NM, CO, ID, MT, UT, WY
Ontario Canada	ON

Micron	% Passing								
	75	106	150	212	300	425	600	1000	
MA Physical Average	1.2	4.6	13.5	30.5	50.0	58.9	67.8	80.6	
MA SES Average	0.5	4.8	28.4	51.7	88.2	94.3	99.2	100.0	
NC Physical Average	3.0	10.3	23.8	39.9	55.8	66.0	74.5	88.1	
NC SES Average	2.0	14.1	38.8	63.9	86.6	97.5	100.0	100.0	
NE Physical Average*	23.3	27.3	34.6	43.6	56.7	67.4	75.7	89.5	
SC Physical Average	2.7	12.0	28.5	43.0	55.0	63.6	72.0	84.1	
SC SES Average	1.2	8.8	37.2	65.6	88.7	95.4	100.0	100.0	
SE Physical Average	1.3	5.7	20.8	41.5	62.7	72.4	82.0	94.4	
SE SES Average	2.1	7.8	29.9	56.1	83.3	90.0	95.0	98.1	
West Canada Physical Average	2.3	9.1	21.7	38.0	54.4	62.2	69.9	82.7	
West Canada SES Average	1.8	8.0	39.3	71.1	94.5	99.2	99.6	100.0	
West US Physical Average	2.4	9.2	20.4	34.5	50.9	59.1	67.6	80.3	
West US SES Average	2.6	11.0	28.2	49.9	74.8	88.1	94.7	99.8	
Ontario Physical Average	2.3	11.0	28.5	46.6	67.2	75.0	82.8	93.5	
Ontario SES Average	0.5	7.0	39.9	70.3	91.3	96.7	100.0	100.0	

\* SES data is not available for the New England Region at this time



Clean Sand



Wastewater Grit

## Learn more

To learn more about the **characteristics of your grit**, visit [hydro-int.com](http://hydro-int.com), or contact us:

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