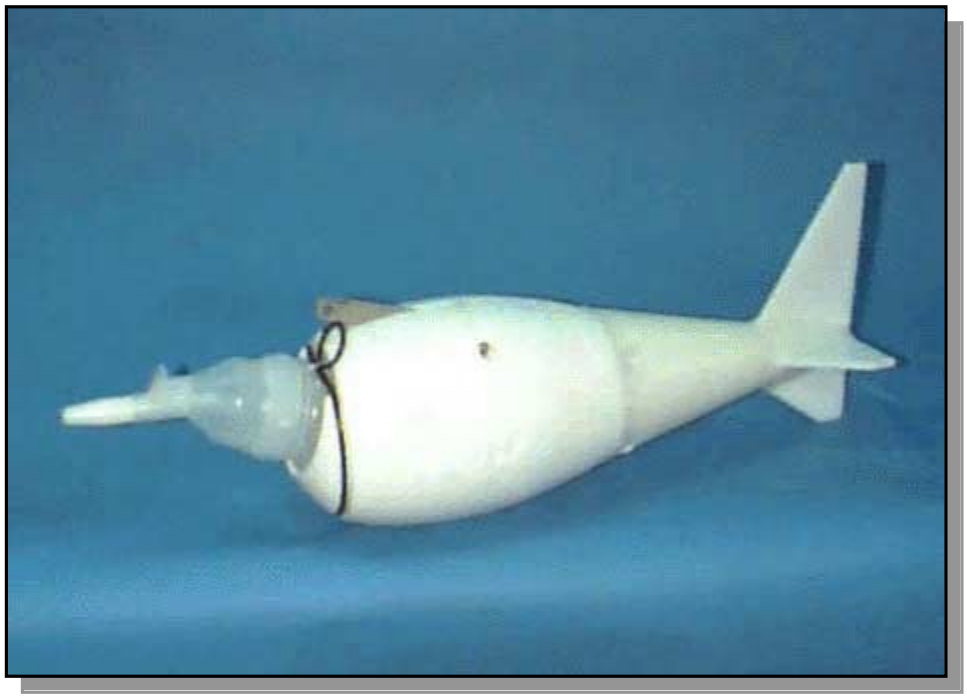
SAMPLING WITH THE US D-95 DEPTH-INTEGRATING SUSPENDED-SEDIMENT SAMPLER



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Sampling with the US D-95 Depth-Integrating Suspended-Sediment Sampler

Characteristics

Description: The US D-95 sampler is a streamlined 64-pound suspended sediment sampler. It has a tail section constructed of plastic and a bronze body coated with plastic to meet the requirements for use as a water-quality sampler. The body coating is a commercially available material with the trade name "PlastiDip". "PlastiDip" can be obtained from many hardware stores and building suppliers and can be applied by the user to make any required repairs to the coating. The US D-95 is designed to collect a depth-integrated, flow-weighted suspended-sediment sample in medium-velocity streams with depths to 15 ft. Both plastic (white) and Teflon 3/16-, 1/4-, and 5/16-inch diameter nozzles are used.

Sampling container: The sampler uses a 1-liter bottle, and a US D-77 cap and nozzle. The bottle, cap, and nozzle are available in plastic and Teflon. When using the Teflon bottle, cap, and nozzle, a threaded Teflon adapter is required to mate the cap to the bottle. The sample bottle is held in place by an o-ring around the front of the sampler and over the neck of the bottle.

Sampler function: When the sampler is submerged with the nozzle pointed into the flow, the water sediment mixture flows through the nozzle into the bottle, forcing air to exhaust out through the air vent hole in the cap.

The use of brand names in this document is for identification purposes only and does not constitute endorsement by the United States Government.

Limitations

Velocity limitations: The US D-95 sampler will collect acceptable flow weighted samples in streams with velocities from 1.7 to 6.7 ft/sec, depending on the nozzle diameter in use. The recommended velocity range for the 3/16-inch nozzle is 1.7 to 6.2 ft/sec. The recommended velocity range for the 1/4-inch nozzle is 1.7 to 6.7 ft/sec. The recommended velocity range for the 5/16-inch nozzle is 2.0 to 6.7 ft/sec. An acceptable velocity range is one at which a representative flow weighted sample is collected at a sampler inflow efficiency between 90% and 110%. Inflow efficiency is defined as the ratio of the sample velocity entering the nozzle to the ambient stream velocity. An inflow efficiency of 100% is referred to as isokinectic. A graphical presentation of recommended velocity ranges and the results of tests to determine inflow efficiencies for the 3/16-, 1/4-, and 5/16-inch diameter nozzles are shown in Figures 2 through 4.

Depth limitation: The US D-95 sampler will collect flow-weighted samples to a maximum depth of 15 ft with the 3/16-, or 1/4-inch diameter nozzles and to 13.3 ft with the 5/16-inch diameter nozzle. The maximum sampling depths are reduced when the sample volume is limited

to the recommended volume of 800 mL. The operator should refer to the transit rate diagrams in Figures 5-10 for specific depth limitations. Filling times for the sampler are shown in Table 1.

Unsampled zone: The US D-95 can sample to within 4.8 inches of the streambed. This unsampled zone is due to the distance between the nozzle and the bottom of the sampler (Figure 1).

Transit rate limitations: The transit rate is the speed of lowering and raising the sampler in the sampling vertical. Acceptable transit rates for the US D-95 sampler with different nozzle diameters and container configurations are presented graphically in Figures 5 through 10.

Instruction for use of the US D-95 sampler

Sampler preparation: Connect the sampler to a hanger bar and the hanger bar to a suspension cable. All hardware, including clamps and cable, should be as small and streamlined as possible. Suspension cable diameter should not exceed 1/8-inch. Bulky hardware increases drag, which will pull the sampler downstream while the sample is being collected. Ideally the sample should be collected along a vertical line. A reel is required to raise and lower the US D-95 sampler. A hand crank model is recommended over most powered reels unless a powered reel with speed control is available.

Select the largest diameter nozzle that the transit rate and depth will allow. Screw the selected nozzle into a clean cap and bottle configuration required for the sampling program. Insure the nozzle is screwed all the way into the cap, but only hand tight. Never use a wrench to tighten a nozzle. If needed, clean the nozzle threads.

Lift the o-ring and place the selected clean bottle-cap configuration in the sampler cavity. The o-ring should fit over the neck of the bottle to hold it in place. Rotate the bottle-cap configuration until the air vent hole in the cap is vertical. Visually check the nozzle intake and air vent hole for any obstructions.

Sampling: Lower the US D-95 sampler to the water surface, but don't submerge the nozzle. The tail will contact the water surface first and align the sampler with the flow. (Note: The US D-95 will not hang horizontal in air. The tail section will be lower than the body. When the sampler is submerged the buoyancy of the tail will raise the tail and align the sampler to horizontal.) Using a constant transit rate selected from one of the graphs presented in Figures 5 through 10, smoothly lower the sampler into the flow. When the streambed is touched, quickly reverse directions, and raise the sampler (using the same constant transit rate) to the surface. Avoid hitting the streambed to prevent stirring up loose sediment that could bias the sample. If sample volumes are not being composited, cap and label each bottle. Each sample label should have the following information: name of stream, location of cross section, date, time of day, gage height, location of the vertical in the cross-section, depth of the vertical, duration of sampling time, water temperature and the operators' names.

Questions and comments regarding sampler operation should be addressed to:

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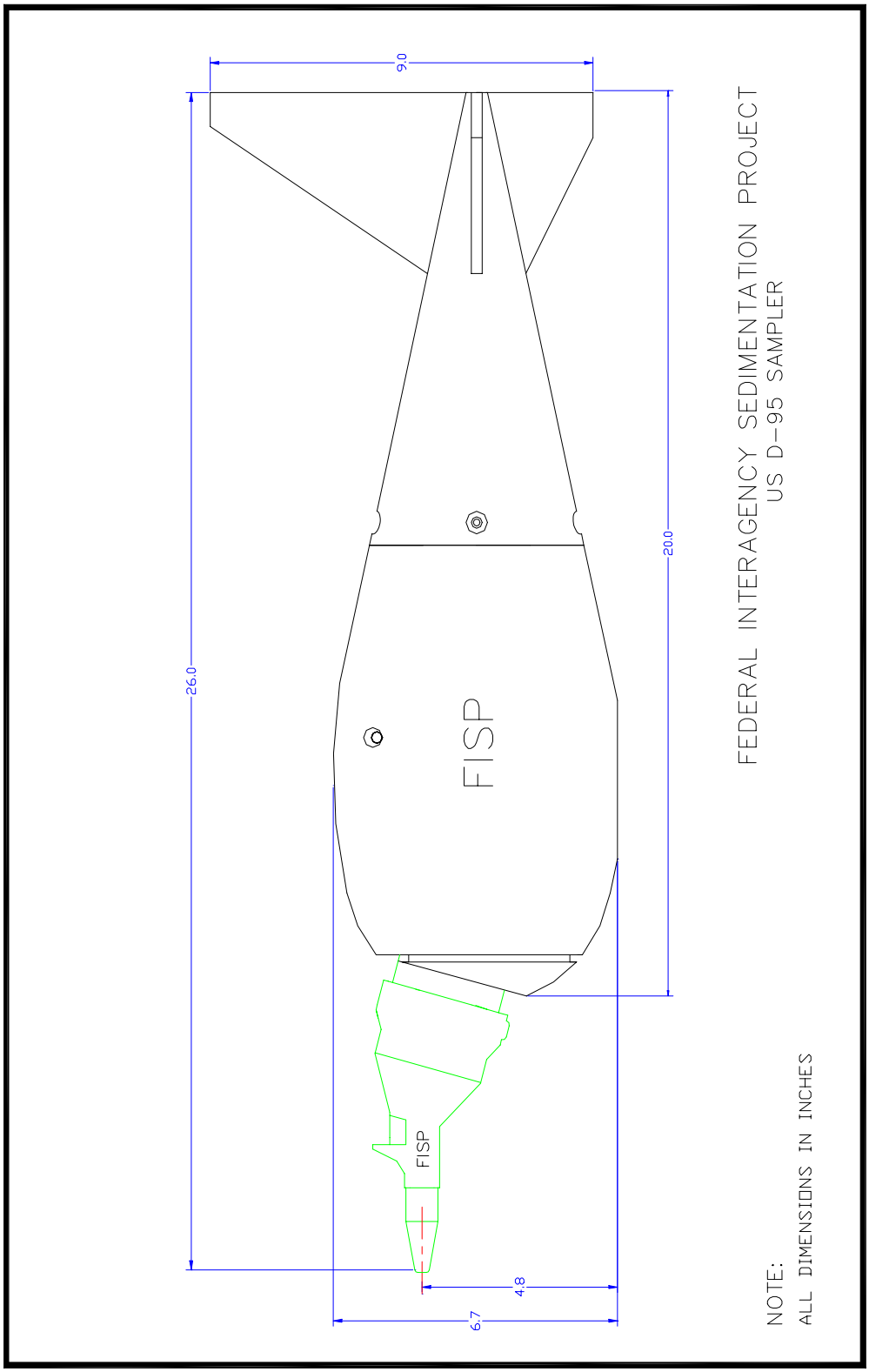


Figure 1. Schematic of the US D-95 Suspended-Sediment Sampler

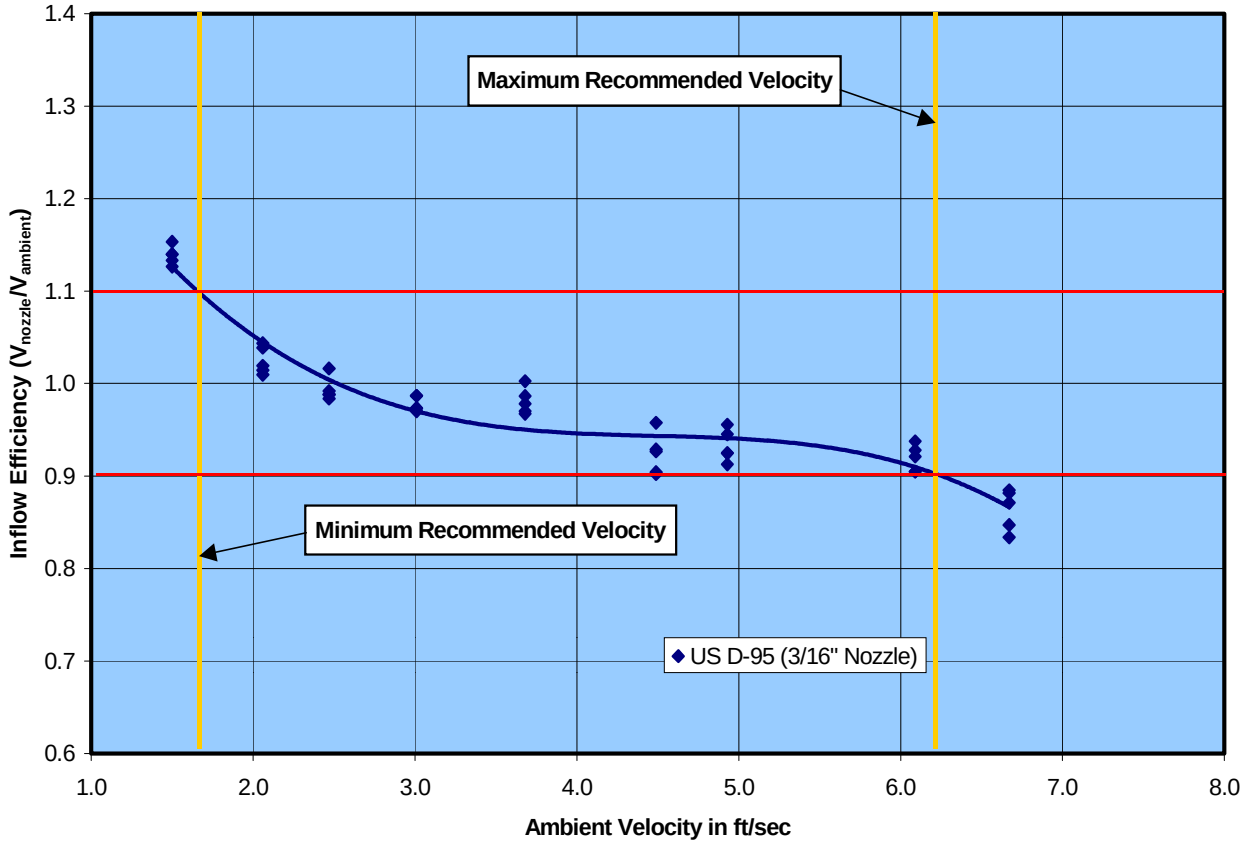


Figure 2. Inflow Efficiency, US D-95, 3/16-inch Nozzle

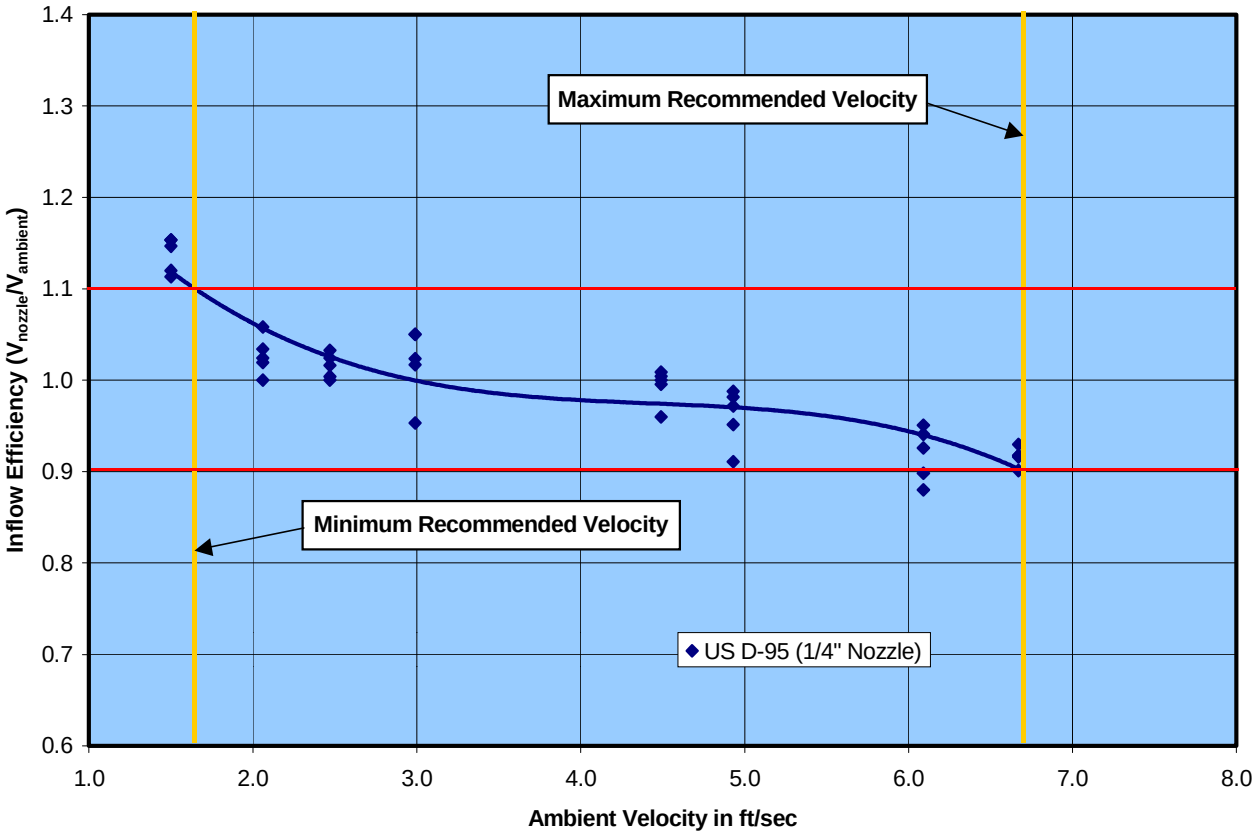


Figure 3. Inflow Efficiency, US D-95, 1/4-inch Nozzle

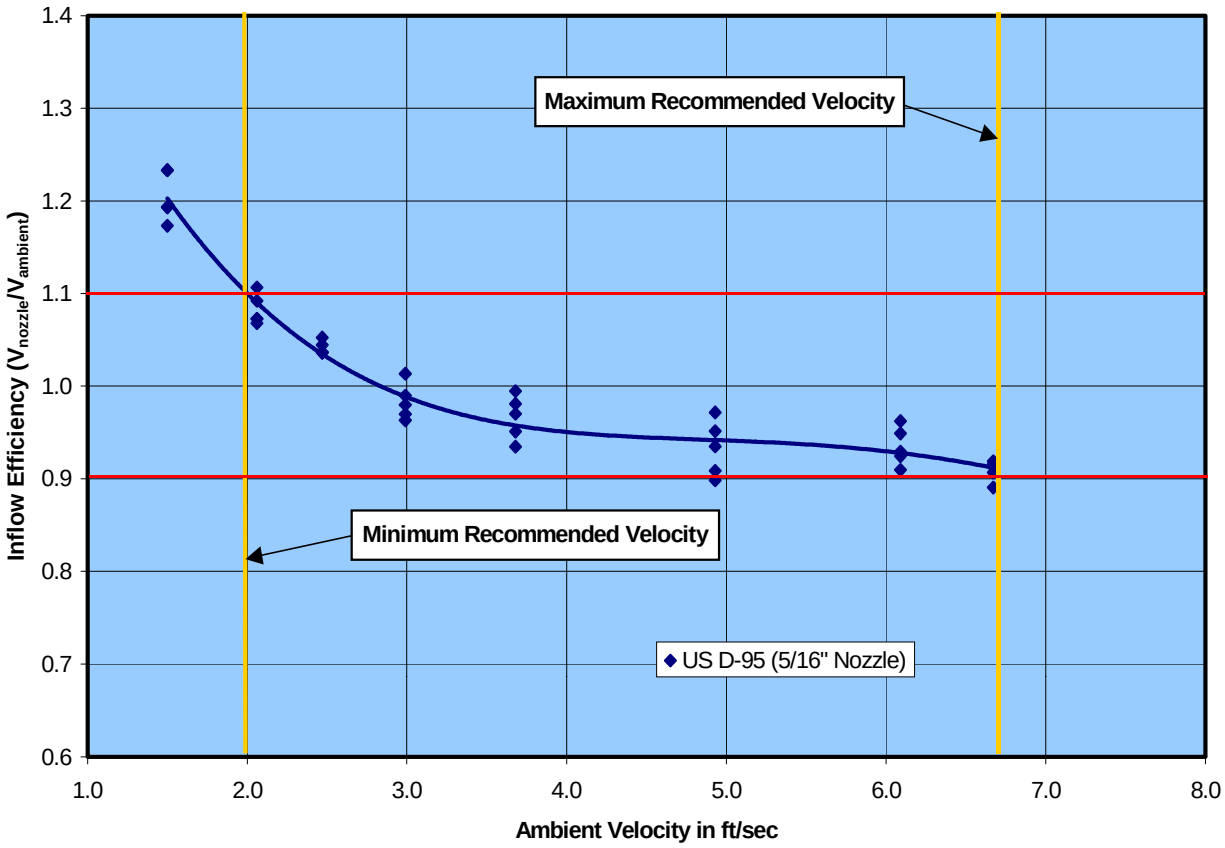
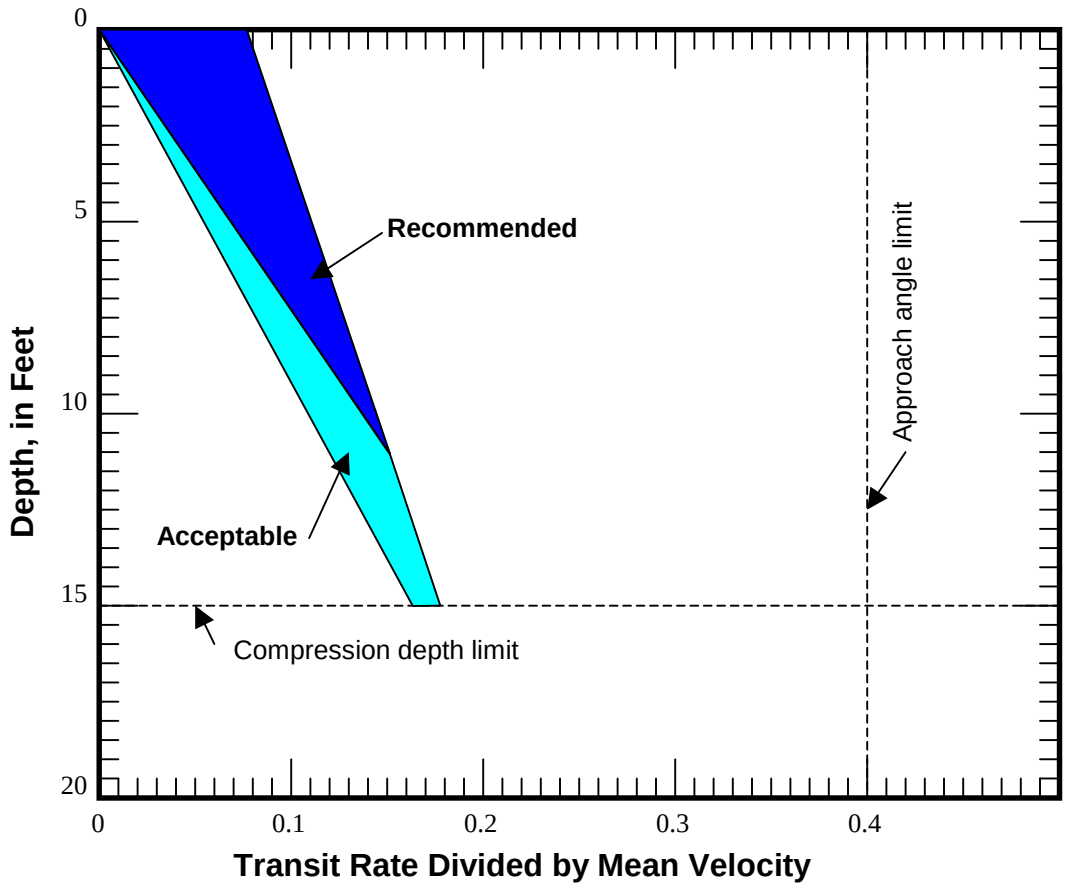
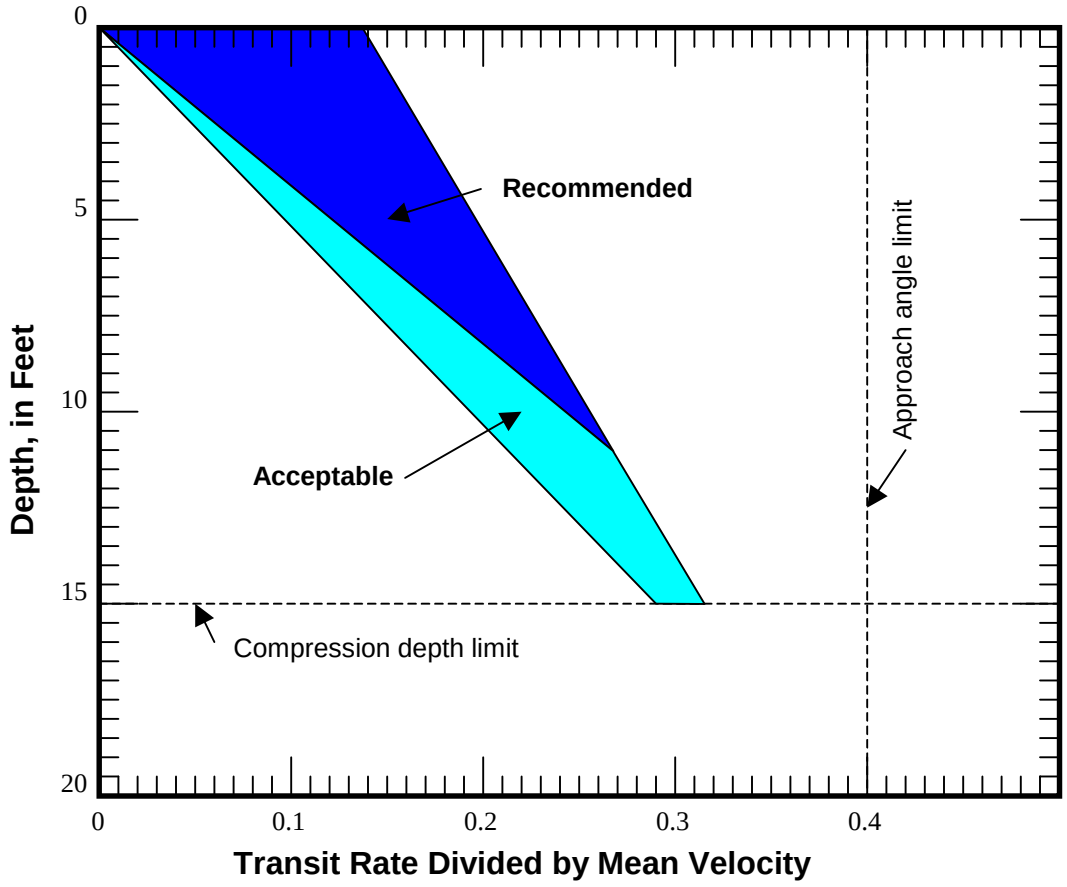


Figure 4. Inflow Efficiency, US D-95, 5/16-inch Nozzle



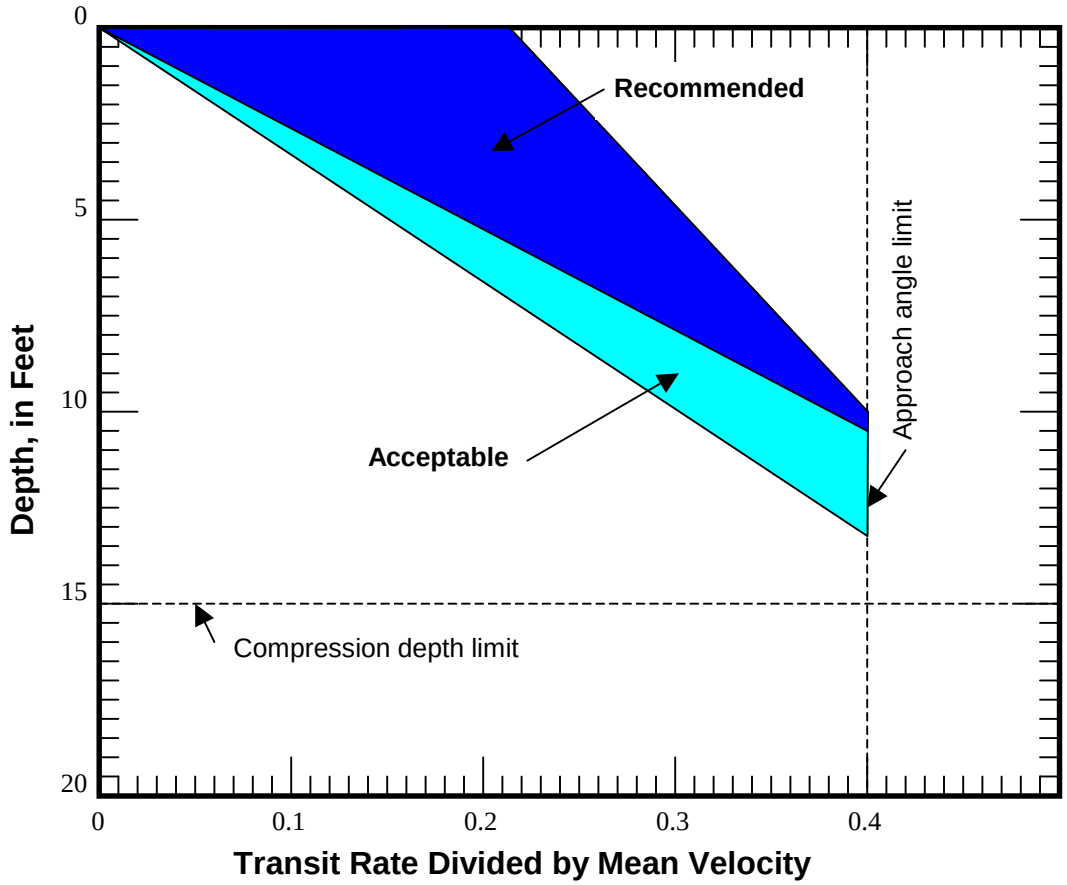
Note: The following configuration and volumes were used to produce this diagram. The total volume of the sampler container is 1215 mL, which includes a polypropylene bottle and US D-77 cap. The maximum recommended sample volume is 800 mL. The maximum acceptable sample volume is 1000 mL.

Figure 5. Transit Rate Diagram for US D-95, 3/16-inch Plastic Nozzle



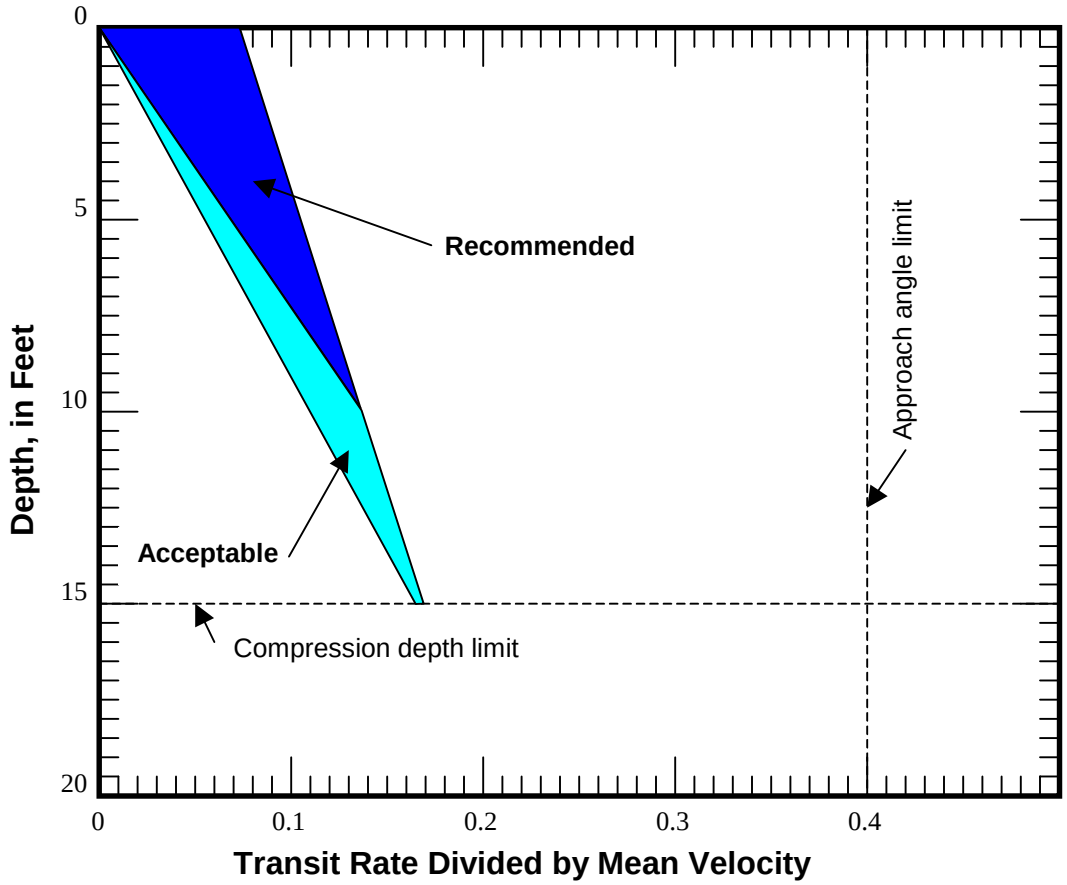
Note: The following configuration and volumes were used to produce this diagram. The total volume of the sampler container is 1215 mL, which includes a polypropylene bottle and US D-77 cap. The maximum recommended sample volume is 800 mL. The maximum acceptable sample volume is 1000 mL.

Figure 6. Transit Rate Diagram for US D-95, 1/4-inch Plastic Nozzle



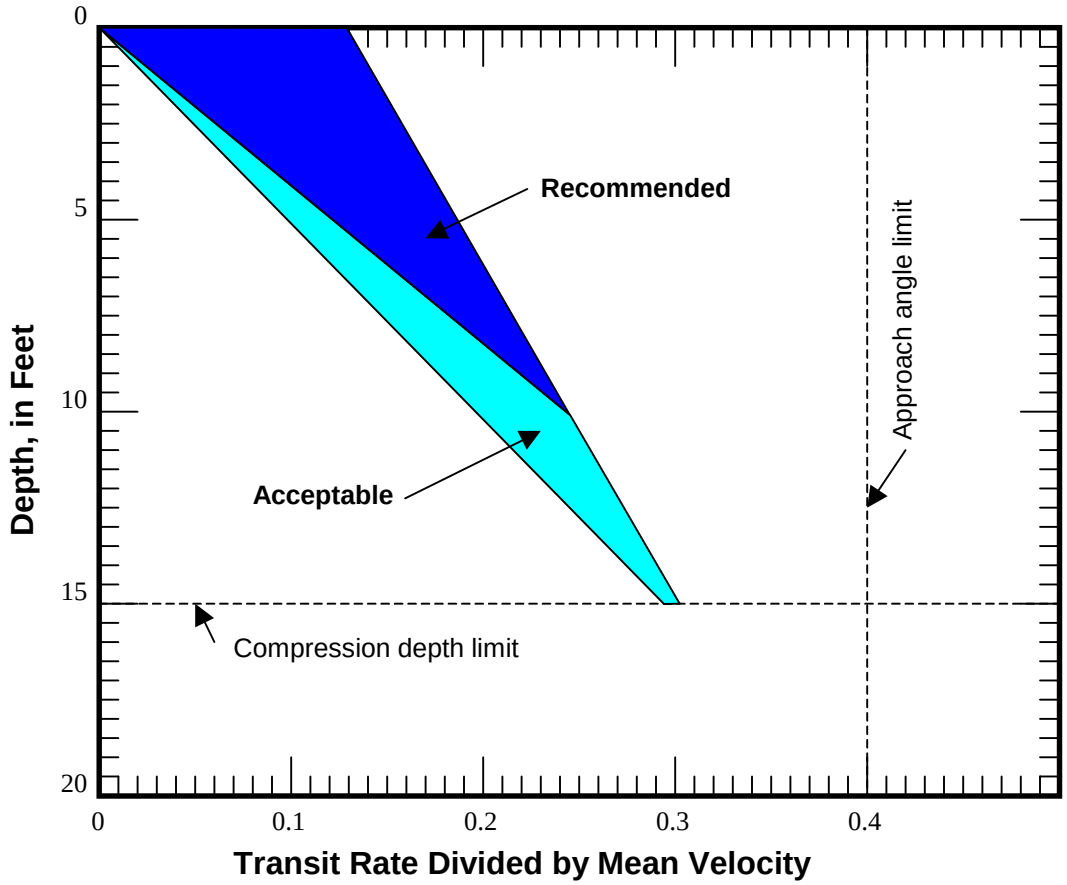
Note: The following configuration and volumes were used to produce this diagram. The total volume of the sampler container is 1215 mL, which includes a polypropylene bottle and US D-77 cap. The maximum recommended sample volume is 800 mL. The maximum acceptable sample volume is 1000 mL.

Figure 7. Transit Rate Diagram for US D-95, 5/16-inch Plastic Nozzle



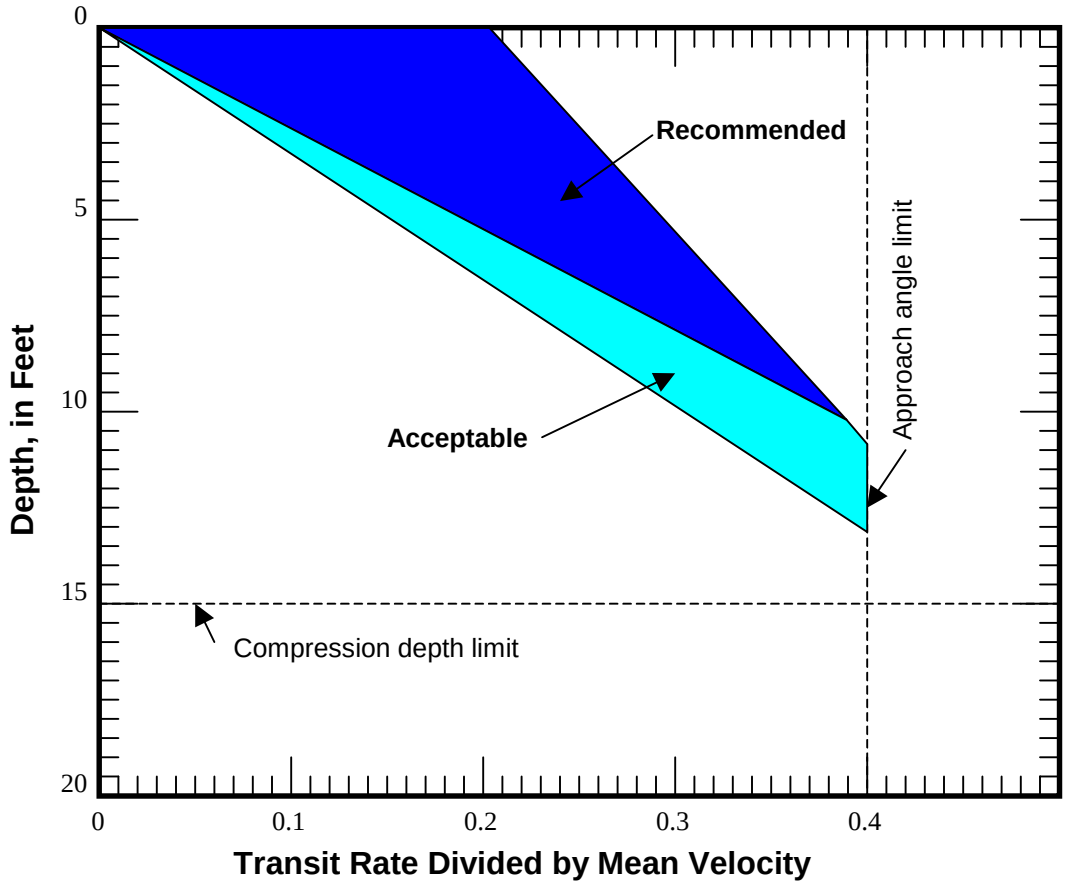
Note: The following configuration and volumes were used to produce this diagram. The total volume of the sampler container is 1265 mL, which includes a Teflon bottle, bottle adapter and US D-77 cap. The maximum recommended sample volume is 800 mL. The maximum acceptable sample volume is 1000 mL.

Figure 8. Transit Rate Diagram for US D-95, 3/16-inch Teflon Nozzle



Note: The following configuration and volumes were used to produce this diagram. The total volume of the sampler container is 1265 mL, which includes a Teflon bottle, bottle adapter and US D-77 cap. The maximum recommended sample volume is 800 mL. The maximum acceptable sample volume is 1000 mL.

Figure 9. Transit Rate Diagram for US D-95, 1/4-inch Teflon Nozzle



Note: The following configuration and volumes were used to produce this diagram. The total volume of the sampler container is 1265 mL, which includes a Teflon bottle, bottle adapter and US D-77 cap. The maximum recommended sample volume is 800 mL. The maximum acceptable sample volume is 1000 mL.

Figure 10. Transit Rate Diagram for US D-95, 5/16-inch Teflon Nozzle

TABLE 1. Filling Times for the US D-95 Sampler

		3/16-inch Nozzle	1/4-inch Nozzle	5/16-inch Nozzle
Velocity in ft/sec	Volume in mL	Time in seconds	Time in seconds	Time in seconds
1.4	800	105	59	38
1.6	800	92	52	33
1.8	800	82	46	29
2.0	800	74	41	27
2.2	800	67	38	24
2.4	800	61	35	22
2.6	800	57	32	20
2.8	800	53	30	19
3.0	800	49	28	18
3.2	800	46	26	17
3.4	800	43	24	16
3.6	800	41	23	15
3.8	800	39	22	14
4.0	800	37	21	13
4.2	800	35	20	13
4.4	800	33	19	12
4.6	800	32	18	12
4.8	800	31	17	11
5.0	800	29	17	11
5.2	800	28	16	10
5.4	800	27	15	10
5.6	800	26	15	9
5.8	800	25	14	9
6.0	800	25	14	9
6.2	800	24	13	9
6.4	800	23	13	8
6.6	800	22	13	8
6.8	800	22	12	8
7.0	800	21	12	8
7.2	800	20	12	7
7.4	800	20	11	7
7.6	800	19	11	7

RECOMMENDED VELOCITY RANGE

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