5 Theoretical Basis for SAM.aid — Guidance in Sediment Transport Function Selection

Purpose

SAM.aid is a module of the SAM package that provides guidance in the selection of the most applicable sediment transport function(s) to use for given hydraulic conditions for a specified river or stream. The traditional approach for selecting a function has involved collecting field data, including both suspended sediment measurements and bed material gradations; processing and testing that data with a number of sediment transport functions; and then selecting the function that best matched the field measurements. Because many of today's projects are on small ungaged streams and because field data are often too limited for this approach to be satisfactorily applied, SAM.aid was developed to provide an alternative in which only bed-material gradations and hydraulic parameters are required.

General

Different functions may give widely differing results for a specified channel. Therefore it is important to test the predictive capability of a sediment transport function against measured data in the project stream or in a similar stream before its adoption for use in a sediment study. Also, different functions were developed from different sets of field and laboratory data and are better suited to some applications than others.

Most sediment transport functions predict a rate of sediment transport for a given set of steady-state hydraulic and bed material conditions. Typically, hydraulic variables are laterally averaged. Some sediment transport functions were developed for calculation of bed-load only, and others were developed for calculation of total bed-material load. This distinction can be critical in sand-bed streams, where the suspended bed-material load may be orders of magnitude greater than the bed-load. Another important difference in sediment transport functions is the manner in which grain size is treated. Most sediment transport functions were developed as single-grain-size functions, usually using the median bed material size to represent the total bed. Single-grain-size functions are most appropriate in cases where equilibrium sediment transport can be assumed, i.e., when the project will not significantly change the existing hydraulic or sediment conditions. When the purpose of the sediment study is to evaluate the effect of a project on sediment transport characteristics, i.e., the project or a flood will introduce non-equilibrium conditions, then a multiple-grain-size sediment transport function should be used. Multiple-grain-size functions are very sensitive to the grain-size distribution of the bed material. Extreme care must be exercised in order to ensure that the fine component of the bed-material gradation is representative of the bed surface for the specified discharge. This is very difficult without measured data. For this reason Einstein (1950) recommended ignoring the finest 10 percent of the bed material sample for computation of bed-material load with a multiple-grain-size function. In HEC-6 and SAM, single-grain-size functions are converted to multiple-grain-size functions simply by calculating sediment transport using geometric mean diameters for each size class in the bed (sediment transport potential) and then assuming that transport of that size class (sediment transport capacity) can be obtained by multiplying the sediment transport potential by the bed fraction. This can produce unreliable results since the assumption is that each size class fraction in the bed acts independent of other size classes on the bed, thus ignoring the effects of hiding.

Description

SAM.aid is based on the premise that a sediment transport function that accurately predicts measured sediment in a gaged stream would be an appropriate predictor in an ungaged stream with similar characteristics. SAM.aid compares calculated "screening parameters" for a given river to the same screening parameters from a database of rivers (Brownlie, 1981) that have sufficient sediment data to determine an appropriate sediment transport function. The "screening parameters" are velocity, depth, slope, width, and d_{50}. It should be noted that Brownlie reduced measured bed material gradations to median grain sizes and geometric standard deviations. This means that this guidance is not applicable to rivers that have bed gradations that are not log-normally distributed.

When the user inputs velocity, depth, slope, width and d_{50} for an ungaged river, SAM.aid compares each of these screening parameters with those of each river in the Brownlie database. A "match" is identified when a parameter falls within the range of data for a database river. The d_{50} must fall within the range for a river in the database before SAM.aid will examine the other parameters. The three best sediment transport functions for each database river is then listed, along with the type of parameter(s) that matched and the name of the data set matched.

After the matches are displayed, the user can check the description of the rivers on which SAM.aid based its choices to see how close those descriptions match the user's river or stream. This is an essential step in ensuring that the sediment transport functions will actually provide the best predictive capability for the river in question. This will also narrow the choices when SAM.aid displays several data sets that "matched" a user's data, all with the same matching screening parameters.

Criteria for selecting sediment transport functions

Discrepancy ratios were calculated for each measured discharge. Raphelt (1996) describes the discrepancy ratio that Yang (1984), van Rijn (1984) and others have used as

$$\frac{q_s \ computed}{q_s \ measured}$$

For each data base, the percentage of discrepancy ratios between 0.5 and 2.0[1] was determined, and the average discrepancy ratio was calculated. The five to eight sediment transport functions with the highest percentage of discrepancy ratios within the selected range were selected first. From these, the functions were ranked by average discrepancy ratio. The function with the discrepancy ratio closest to 1.0 was ranked highest.

Only one of the Toffaleti function combinations was considered in each ranking. For instance, if both the Toffaleti and the Toffaleti-Schoklitsch functions ranked in the top three, only the function with the highest ranking would be included in the final recommendations. For some functions, sediment transport is calculated two ways: 1) assuming a median grain size and 2) making calculations by size class fractions. For these functions only the multiple grain size option was considered in the rankings. Since the Brownlie function calculates sediment transport using only the median grain size, it is included in the rankings.

In some cases, when the data is clearly outside the range for which a sediment transport function was developed, a function was excluded from the rankings.

The rankings for all the sediment transport functions in SAM.sed, for all the data sets in SAM.aid, are given in tables 5.2 through 5.21. They are also available onscreen in SAM.aid as part of the site description, allowing the user to apply personal engineering judgement and experience. This is an important feature to remember since the results of SAM.aid are meant only as suggestions, for guidance.

[1] This range, 0.5 to 2.0 was chosen because it is the range that is used in many other researchers in this field: van Rijn (1984a), Alonso (1980), White, Milli and Crabbe (1975), among others.

Table 5.1. LIST OF BROWNLIE DATA SETS	
Data Code	River and Investigator(s)
ACP	ACOP Canal, k. Mahmood et al., 1979
AMC	American Canal, D. B. Simons, 1957
ATC	Atchafalaya River, F. B. Toffaleti, 1968
CHO	Chop Canals, Chaudhry et al., 1970
COL	Colorado River, U. S. Bureau of Reclamation, 1958
HII	Hii River, K. Shinohara and T. Tsubaki, 1959
LEO	River Data, L. B. Leopold, 1969
MID	Middle Loup River, D. Hubbell and D. Matejka, 1959
MIS	Mississippi River, F. B. Toffaleti, 1968
MOU	Mountain Creek, H. A. Einstein, 1944
NED	Rio Magdelena and Canal del Dique, NEDCO, 1973
NIO	Niobrara River, B. R. Colby and C. H. Hembree, 1955
NSR	North Saskatchewan River and Elbow River, G. W. Samide, 191
OAK	Oak Creek, Oregon, R. T. Milhous. 1973
POR	Portugal Rivers, L. V. da Cunha, 1969
RED	Red River, F. B. Toffaleti, 1968
RGC	Rio Grande Conveyance Channel, J. K. Culbertson et al., 1976
RGR	Rio Grande River, C. F. Nordin and C. P. Beverage, 1965
RIO	Rio Grande near Bernalillo, NM, F. B. Toffaleti, 1968

Table 5.2. Sediment Transport Function Rankings for ACP Data Set.

DATA SET: ACP	# DATA POINTS IN SET: 142		
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
TOFFALETI-MPM	57.04	1.343	1.2863
TOFFALETI. **3**	56.34	1.222	1.2112
TOFFALETI-SCHOKLITSCH	55.63	1.305	1.2650
LAURSEN(COPELAND)	54.93	1.567	1.7284
PROFITT(SUTHERLAND)	54.23	1.716	1.6165
LAURSEN(MADDEN),1985	53.52	1.440	1.7098
ACKERS-WHITE. **2**	50.70	0.830	0.7461
ACKERS-WHITE, D50	49.30	0.859	0.7996
ENGELUND-HANSEN **1**	45.77	1.019	0.9600
BROWNLIE, D50	44.37	0.812	0.7816
VAN RIJN	41.55	0.731	0.8370
COLBY	40.14	1.456	1.6258
EINSTEIN(TOTAL-LOAD)	37.32	1.405	1.9642
YANG, D50	31.69	0.445	0.7005
YANG.	26.76	0.416	0.7059
EINSTEIN(BED-LOAD)	21.13	0.370	0.8619
MPM(1948),D50	5.63	0.158	0.8590
MPM(1948).	2.11	0.137	0.8759
SCHOKLITSCH	0.70	0.094	0.9140
PARKER	0.00	0.000	1.0035

Table 5.3. Sediment Transport Function Rankings for AMC Data Set.

DATA SET: AMC	# DATA POINTS	IN SET: 11	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
LAURSEN(COPELAND) **1**	45.45	1.092	1.2213
PROFITT(SUTHERLAND)	45.45	0.462	0.6777
BROWNLIE, D50	27.27	0.309	0.7708
LAURSEN(MADDEN),1985 **3**	27.27	0.690	0.8809
ENGELUND-HANSEN	27.27	0.434	0.6877
ACKERS-WHITE, D50	27.27	0.294	0.7822
COLBY	27.27	0.370	0.7592
ACKERS-WHITE.	27.27	0.283	0.7858
EINSTEIN(TOTAL-LOAD) **2**	27.27	0.741	1.2944
TOFFALETI.	18.18	0.455	0.8375
YANG.	18.18	0.270	0.8012
EINSTEIN(BED-LOAD)	18.18	0.230	0.8374
VAN RIJN	18.18	0.359	0.7513
TOFFALETI-MPM	18.18	0.579	0.7908
TOFFALETI-SCHOKLITSCH	18.18	0.490	0.8215
YANG, D50	18.18	0.265	0.8115
MPM(1948),D50	9.09	0.175	0.8835
SCHOKLITSCH	0.00	0.041	1.0068
MPM(1948).	0.00	0.150	0.9008
PARKER	0.00	0.001	1.0473

Table 5.4. Sediment Transport Function Rankings for ATC Data Set.

DATA SET: ATC	# DATA POINTS	IN SET: 63	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
COLBY	69.84	1.285	1.0056
LAURSEN(COPELAND) **3**	69.84	1.140	1.2790
LAURSEN(MADDEN),1985 **1**	68.25	1.104	1.1584
TOFFALETI-MPM	65.08	1.169	1.3231
TOFFALETI. **2**	63.49	1.132	1.3043
TOFFALETI-SCHOKLITSCH	63.49	1.142	1.3154
PROFITT(SUTHERLAND)	57.14	1.197	1.3708
VAN RIJN	42.86	0.621	0.7357
BROWNLIE, D50	39.68	0.533	0.5941
ACKERS-WHITE.	36.51	0.657	0.8902
ENGELUND-HANSEN	34.92	0.498	0.6517
ACKERS-WHITE, D50	33.33	0.521	0.6789
EINSTEIN(TOTAL-LOAD)	20.63	4.208	5.8703
EINSTEIN(BED-LOAD)	7.94	0.182	0.8557
YANG.	3.17	0.132	0.8832
YANG, D50	1.59	0.137	0.8784
SCHOKLITSCH	0.00	0.012	0.9959
MPM(1948).	0.00	0.056	0.9522
MPM(1948),D50	0.00	0.070	0.9389
PARKER	0.00	0.000	1.0080

Table 5.5. Sediment Transport Function Rankings for CHO Data Set.

DATA SET: CHO	# DATA POINTS	IN SET: 33	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
COLBY **1**	69.70	0.826	0.5573
PROFITT(SUTHERLAND)	54.55	2.743	5.2183
ACKERS-WHITE, D50	51.52	1.201	1.9122
ENGELUND-HANSEN **3**	48.48	0.753	0.7301
BROWNLIE, D50	45.45	0.635	0.6155
LAURSEN(COPELAND)	42.42	2.347	5.6214
ACKERS-WHITE. **2**	42.42	1.211	1.9239
VAN RIJN	33.33	0.986	1.3950
TOFFALETI-MPM	27.27	1.603	2.8109
TOFFALETI-SCHOKLITSCH	27.27	1.604	2.8167
EINSTEIN(TOTAL-LOAD)	21.21	2.372	6.9618
YANG, D50	18.18	0.467	0.7810
YANG.	18.18	0.422	0.7588
LAURSEN(MADDEN),1985	18.18	1.897	3.9564
TOFFALETI.	15.15	1.541	2.7744
SCHOKLITSCH	0.00	0.079	0.9387
MPM(1948).	0.00	0.075	0.9404
MPM(1948),D50	0.00	0.085	0.9308
PARKER	0.00	0.000	1.0155
EINSTEIN(BED-LOAD)	0.00	0.113	0.9050

Table 5.6. Sediment Transport Function Rankings for COL Data Set.

DATA SET: COL	# DATA POINTS	IN SET: 100	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
PROFITT(SUTHERLAND)	72.00	1.249	1.4127
COLBY **2**	68.00	1.144	1.5363
ENGELUND-HANSEN **1**	62.00	1.004	0.8986
LAURSEN(COPELAND) **3**	50.00	0.851	1.1833
ACKERS-WHITE, D50	49.00	0.700	0.8543
BROWNLIE, D50	48.00	0.704	0.8256
ACKERS-WHITE.	44.00	0.672	0.8588
TOFFALETI-MPM	39.00	0.624	0.7591
TOFFALETI-SCHOKLITSCH	39.00	0.614	0.7486
YANG.	38.00	0.472	0.6868
YANG, D50	38.00	0.503	0.6802
LAURSEN(MADDEN),1985	32.00	0.595	0.7617
VAN RIJN	31.00	0.518	0.9252
TOFFALETI.	29.00	0.502	0.7606
EINSTEIN(TOTAL-LOAD)	27.00	0.587	0.8892
EINSTEIN(BED-LOAD)	14.00	0.298	0.7617
SCHOKLITSCH	2.00	0.123	0.8885
MPM(1948).	2.00	0.136	0.8771
MPM(1948),D50	2.00	0.159	0.8575
PARKER	0.00	0.000	1.0050

Table 5.7. Sediment Transport Function Rankings for HII Data Set.

DATA SET: HII	# DATA POINTS	IN SET: 38	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
YANG.	94.74	1.290	0.5404
EINSTEIN(BED-LOAD) **2**	86.84	1.219	0.6851
ENGELUND-HANSEN	84.21	1.246	0.6062
PROFITT(SUTHERLAND) **3**	81.58	1.225	0.6691
TOFFALETI-MPM **1**	78.95	0.815	0.4836
EINSTEIN(TOTAL-LOAD)	73.68	1.586	1.0890
ACKERS-WHITE,D50	68.42	0.667	0.4901
ACKERS-WHITE.	68.42	0.623	0.4999
VAN.RIJN	65.79	0.898	0.7972
YANG,D50	63.16	1.806	1.0598
BROWNLIE,D50	52.63	0.513	0.5586
MPM(1948),D50	52.63	0.661	0.5770
MPM(1948).	50.00	0.535	0.6076
LAURSEN(COPELAND)	44.74	2.500	2.1361
TOFFALETI-SCHOKLITSC	42.11	1.512	1.4665
COLBY	42.11	0.571	0.8030
SCHOKLITSCH	42.11	1.230	1.2945
TOFFALETI.	28.95	0.338	0.7500
LAURSEN(MADDEN),1985	26.32	0.370	0.7345
PARKER	13.16	0.258	0.8996

Table 5.8. Sediment Transport Function Rankings for LEO Data Set.

DATA SET: LEO		# DATA POINTS	IN SET: 55	
FUNCTION		Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
COLBY	3	61.82	1.351	1.0382
PROFITT(SUTHERLAND)		56.36	2.245	2.8644
BROWNLIE,D50	2	56.36	0.907	0.7016
ACKERS-WHITE,D50	1	49.09	1.013	0.8411
YANG,D50		47.27	0.699	0.6532
YANG.		47.27	0.674	0.6592
ENGELUND-HANSEN		45.45	1.393	1.2055
ACKERS-WHITE.		45.45	1.274	1.5971
LAURSEN(COPELAND)		38.18	1.290	1.5349
TOFFALETI-MPM		38.18	1.016	1.1138
TOFFALETI-SCHOKLITSC		36.36	1.024	1.1624
VAN.RIJN		36.36	0.806	0.9061
EINSTEIN(TOTAL-LOAD)		34.55	0.847	1.8083
TOFFALETI.		32.73	0.876	1.0742
LAURSEN(MADDEN),1985		29.09	1.496	2.5647
EINSTEIN(BED-LOAD)		14.55	0.303	0.7613
SCHOKLITSCH		5.45	0.167	0.8556
MPM(1948),D50		3.64	0.179	0.8404
MPM(1948).		1.82	0.155	0.8614
PARKER		0.00	0.000	1.0092

Table 5.9. Sediment Transport Function Rankings for MID Data Set.

DATA SET: MID		# DATA POINTS	IN SET: 38	
FUNCTION		Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
ENGELUND-HANSEN	1	89.47	0.947	0.3875
TOFFALETI-SCHOKLITSCH	2	89.47	0.908	0.4413
COLBY		86.84	0.839	0.4599
PROFITT(SUTHERLAND)		86.84	1.349	0.8418
YANG.	3	84.21	0.866	0.4175
YANG, D50		84.21	0.850	0.4042
ACKERS-WHITE, D50		81.58	0.792	0.4271
ACKERS-WHITE.		81.58	0.788	0.4664
VAN RIJN		81.58	0.862	0.7021
LAURSEN(MADDEN),1985		71.05	0.785	0.7419
TOFFALETI-MPM		71.05	0.710	0.4879
EINSTEIN(TOTAL-LOAD)		65.79	0.964	1.6763
BROWNLIE, D50		60.53	0.613	0.4689
LAURSEN(COPELAND)		44.74	2.528	3.6580
SCHOKLITSCH		36.84	0.448	0.5931
TOFFALETI.		34.21	0.487	0.6241
EINSTEIN(BED-LOAD)		18.42	0.381	0.6417
MPM(1948),D50		2.63	0.286	0.7324
PARKER		0.00	0.001	1.0120
MPM(1948).		0.00	0.235	0.7798

Table 5.10. Sediment Transport Function Rankings for MIS Data Set.

DATA SET: MIS	# DATA POINTS	IN SET: 164	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
COLBY	76.22	1.547	1.0581
BROWNLIE, D50 **3**	73.17	0.830	0.4689
PROFITT(SUTHERLAND)	67.68	1.491	1.4003
ACKERS-WHITE, D50	65.85	0.720	0.5006
ENGELUND-HANSEN **2**	65.85	1.081	0.7669
LAURSEN(COPELAND) **1**	56.10	1.048	1.0764
ACKERS-WHITE.	51.83	1.093	1.2248
VAN RIJN	50.61	0.848	0.6916
TOFFALETI-MPM	48.78	0.976	0.9019
TOFFALETI-SCHOKLITSCH	46.34	0.927	0.8960
TOFFALETI.	44.51	0.882	0.8655
LAURSEN(MADDEN),1985	41.46	1.393	2.5404
YANG.	39.02	0.457	0.6310
YANG, D50	38.41	0.453	0.6288
EINSTEIN(TOTAL-LOAD)	20.12	3.611	6.4857
EINSTEIN(BED-LOAD)	3.05	0.179	0.8375
MPM(1948),D50	2.44	0.147	0.8618
SCHOKLITSCH	0.00	0.052	0.9525
MPM(1948).	0.00	0.119	0.8871
PARKER	0.00	0.004	0.9990

Table 5.11. Sediment Transport Function Rankings for MOU Data Set.

DATA SET: MOU	# DATA POINTS	IN SET: 100	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
MPM(1948). **1**	89.00	1.055	0.4512
MPM(1948),D50	86.00	1.151	0.5324
BROWNLIE, D50 **2**	85.00	1.159	0.8983
ACKERS-WHITE. **3**	80.00	1.510	1.4543
ACKERS-WHITE, D50	76.00	1.668	1.5602
TOFFALETI-MPM	72.00	1.630	1.3082
ENGELUND-HANSEN	71.00	1.938	1.5777
YANG.	68.00	2.015	1.6222
EINSTEIN(BED-LOAD)	67.00	1.764	1.2732
TOFFALETI-SCHOKLITSCH	62.00	1.463	1.4282
COLBY	61.00	1.859	1.7847
EINSTEIN(TOTAL-LOAD)	61.00	2.314	2.3943
YANG, D50	60.00	2.241	1.8333
TOFFALETI.	42.00	0.801	1.0200
VAN RIJN	39.00	2.896	2.7415
PROFITT(SUTHERLAND)	33.00	3.124	3.1845
SCHOKLITSCH	33.00	0.740	0.8733
LAURSEN(MADDEN),1985	17.00	0.587	0.8257
LAURSEN(COPELAND)	9.00	6.768	8.6024
PARKER	7.00	0.109	0.9213

Table 5.12. Sediment Transport Function Rankings for NED Data Set.

DATA SET: NED		# DATA POINTS	IN SET: 66	
FUNCTION		Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
VAN RIJN	**2**	53.03	0.940	0.9852
BROWNLIE, D50		53.03	0.650	0.5866
COLBY		50.00	1.933	10.0131
PROFITT(SUTHERLAND)		50.00	1.103	1.3030
ENGELUND-HANSEN	**1**	48.48	1.000	0.8293
YANG, D50		42.42	0.596	0.7126
TOFFALETI-SCHOKLITSCH	**3**	42.42	1.090	1.3328
TOFFALETI-MPM		40.91	1.123	1.3662
ACKERS-WHITE.		40.91	0.761	0.8038
TOFFALETI.		37.88	1.016	1.3059
YANG.		37.88	0.507	0.6720
ACKERS-WHITE, D50		31.82	0.588	0.7186
LAURSEN(MADDEN),1985		31.82	1.163	1.4970
LAURSEN(COPELAND)		30.30	1.687	2.2986
EINSTEIN(TOTAL-LOAD)		13.64	1.587	3.6978
EINSTEIN(BED-LOAD)		9.09	0.201	0.8536
MPM(1948),D50		6.06	0.180	0.8585
MPM(1948).		3.03	0.137	0.8842
SCHOKLITSCH		1.52	0.098	0.9163
PARKER		0.00	0.029	0.9827

Table 5.13. Sediment Transport Function Rankings for NIO Data Set.

DATA SET: NIO		# DATA POINTS	IN SET: 40	
FUNCTION		Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
BROWNLIE, D50		97.50	0.804	0.3088
TOFFALETI-SCHOKLITSCH		97.50	1.166	0.4614
YANG, D50		97.50	1.158	0.3790
ACKERS-WHITE, D50		97.50	1.060	0.4113
YANG.	**2**	97.50	1.170	0.3763
TOFFALETI-MPM	**1**	92.50	0.954	0.4436
ENGELUND-HANSEN		92.50	1.378	0.5148
COLBY	**3**	92.50	0.832	0.3227
ACKERS-WHITE.		87.50	1.242	0.6482
VAN RIJN		85.00	1.223	0.7311
TOFFALETI.		72.50	0.774	0.4962
LAURSEN(MADDEN),1985		70.00	1.328	0.8450
EINSTEIN(TOTAL-LOAD)		67.50	1.188	0.8245
PROFITT(SUTHERLAND)		60.00	1.953	1.2746
LAURSEN(COPELAND)		47.50	2.624	2.2278
SCHOKLITSCH		30.00	0.490	0.5416
EINSTEIN(BED-LOAD)		7.50	0.298	0.7168
MPM(1948),D50		0.00	0.215	0.7974
PARKER		0.00	0.000	1.0127
MPM(1948).		0.00	0.186	0.8264

Table 5.14. Sediment Transport Function Rankings for NSR Data Set.

DATA SET: NSR		# DATA POINTS	IN SET: 55	
FUNCTION		Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
LAURSEN(MADDEN),1985	**1**	58.18	1.475	1.6476
SCHOKLITSCH	**3**	56.36	2.317	2.8571
TOFFALETI-SCHOKLITSCH		56.36	2.384	2.8983
BROWNLIE, D50	**2**	50.91	1.703	2.0211
VAN RIJN		47.27	0.950	0.8668
ACKERS-WHITE.		43.64	3.268	5.9799
ACKERS-WHITE, D50		34.55	3.806	7.4862
PARKER		27.27	6.603	13.3796
PROFITT(SUTHERLAND)		21.82	6.493	11.2715
YANG.		21.82	6.255	10.2682
YANG, D50		20.00	9.118	15.4717
MPM(1948),D50		14.55	6.661	12.1554
MPM(1948).		9.09	7.636	11.1704
TOFFALETI-MPM		9.09	7.712	11.2263
TOFFALETI.		7.27	0.161	0.8634
EINSTEIN(BED-LOAD)		1.82	13.757	18.6927
EINSTEIN(TOTAL-LOAD)		1.82	13.762	18.6946
LAURSEN(COPELAND)		1.82	20.655	26.6636
COLBY		0.00	0.000	1.0092
ENGELUND-HANSEN		0.00	21.050	28.2610

Table 5.15. Sediment Transport Function Rankings for OAK Data Set.

DATA SET: OAK		# DATA POINTS	IN SET: 17	
FUNCTION		Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
LAURSEN(MADDEN),1985	**1**	41.18	1.081	1.0122
ACKERS-WHITE.		29.41	0.373	0.8095
TOFFALETI.		29.41	0.850	0.9430
YANG.	**2**	29.41	1.142	2.0338
BROWNLIE, D50	**3**	17.65	0.862	1.3960
MPM(1948),D50		5.88	2.651	5.7522
PROFITT(SUTHERLAND)		5.88	0.136	0.9356
PARKER		0.00	185.278	274.7783
VAN RIJN		0.00	181.225	326.1328
SCHOKLITSCH		0.00	56.861	79.6337
ENGELUND-HANSEN		0.00	89.682	119.9400
EINSTEIN(BED-LOAD)		0.00	25.277	33.3275
ACKERS-WHITE, D50		0.00	0.000	1.0308
TOFFALETI-SCHOKLITSCH		0.00	57.585	80.6903
COLBY		0.00	0.000	1.0308
EINSTEIN(TOTAL-LOAD)		0.00	25.301	33.3628
MPM(1948).		0.00	27.752	40.5980
YANG, D50		0.00	0.019	1.0141
LAURSEN(COPELAND)		0.00	108.222	160.7211
TOFFALETI-MPM		0.00	28.486	41.5653

Table 5.16. Sediment Transport Function Rankings for POR Data Set.

DATA SET: POR	# DATA POINTS	IN SET: 219	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
YANG. **1**	87.21	1.009	0.4888
LAURSEN(COPELAND) **2**	67.58	1.245	0.9824
ENGELUND-HANSEN **3**	65.75	1.933	1.3088
BROWNLIE, D50	48.86	0.563	0.5322
PROFITT(SUTHERLAND)	44.75	0.613	0.5739
EINSTEIN(TOTAL-LOAD)	43.38	0.734	0.6747
MPM(1948),D50	42.92	0.538	0.5646
EINSTEIN(BED-LOAD)	42.92	0.722	0.6683
PARKER	41.10	1.803	1.4934
TOFFALETI-MPM	35.62	0.542	0.5668
MPM(1948).	31.51	0.485	0.5952
ACKERS-WHITE.	23.74	0.387	0.6626
VAN RIJN	19.63	0.386	0.7461
TOFFALETI-SCHOKLITSCH	17.81	0.378	0.6486
ACKERS-WHITE, D50	12.33	0.279	0.7487
SCHOKLITSCH	10.96	0.313	0.7109
YANG, D50	2.28	0.103	0.9062
COLBY	0.46	0.131	0.8756
TOFFALETI.	0.00	0.086	0.9198
LAURSEN(MADDEN),1985	0.00	0.117	0.8882

Table 5.17. Sediment Transport Function Rankings for RED Data Set.

DATA SET: RED	# DATA POINTS	IN SET: 30	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
TOFFALETI-MPM	93.33	0.968	0.3799
TOFFALETI-SCHOKLITSCH **1**	90.00	1.010	0.4302
ACKERS-WHITE. **3**	86.67	1.047	0.8088
LAURSEN(COPELAND) **2**	83.33	0.960	0.5720
TOFFALETI.	83.33	0.895	0.3838
ENGELUND-HANSEN	66.67	1.239	1.2817
PROFITT(SUTHERLAND)	63.33	2.167	2.6062
LAURSEN(MADDEN),1985	60.00	2.348	2.0326
ACKERS-WHITE, D50	50.00	0.874	0.9478
EINSTEIN(TOTAL-LOAD)	30.00	2.176	2.9836
BROWNLIE, D50	26.67	0.462	0.5873
VAN RIJN	23.33	0.352	0.6771
COLBY	16.67	0.353	0.7126
YANG, D50	13.33	0.369	0.7336
EINSTEIN(BED-LOAD)	10.00	0.177	0.8616
YANG.	10.00	0.339	0.7302
SCHOKLITSCH	3.33	0.116	0.9108
MPM(1948).	0.00	0.073	0.9442
MPM(1948),D50	0.00	0.091	0.9269
PARKER	0.00	0.000	1.0171

Table 5.18. Sediment Transport Function Rankings for RGC Data Set.

DATA SET: RGC	# DATA POINTS	IN SET: 8	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
TOFFALETI-MPM	87.50	0.932	0.6064
TOFFALETI-SCHOKLITSCH **1**	87.50	0.983	0.5786
LAURSEN(MADDEN),1985 **3**	87.50	0.910	0.4430
ENGELUND-HANSEN **2**	87.50	0.955	0.3160
YANG, D50	87.50	0.656	0.4267
YANG.	75.00	0.612	0.4568
LAURSEN(COPELAND)	75.00	1.407	1.2483
ACKERS-WHITE, D50	75.00	0.814	0.4445
VAN RIJN	75.00	0.834	0.5599
PROFITT(SUTHERLAND)	75.00	1.578	1.1581
BROWNLIE, D50	75.00	0.603	0.4792
COLBY	75.00	0.626	0.4480
ACKERS-WHITE.	75.00	0.912	0.6165
TOFFALETI.	62.50	0.862	0.6174
EINSTEIN(TOTAL-LOAD)	50.00	0.813	0.6449
SCHOKLITSCH	0.00	0.165	0.8947
MPM(1948).	0.00	0.072	0.9923
MPM(1948),D50	0.00	0.082	0.9821
PARKER	0.00	0.000	1.0690
EINSTEIN(BED-LOAD)	0.00	0.112	0.9505

Table 5.19. Sediment Transport Function Rankings for RGR Data Set.

DATA SET: RGR	# DATA POINTS	IN SET: 286	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
PROFITT(SUTHERLAND)	59.79	1.448	1.9547
ENGELUND-HANSEN	58.39	2.175	7.4489
LAURSEN(COPELAND)	53.50	2.370	3.7390
YANG, D50	52.80	1.202	2.7583
TOFFALETI-SCHOKLITSCH	50.00	1.442	4.3807
YANG.	48.95	1.208	2.5535
ACKERS-WHITE.	44.06	1.279	2.7020
ACKERS-WHITE, D50	43.36	0.703	0.8658
VAN RIJN	42.66	0.929	1.3087
BROWNLIE, D50	40.56	0.675	0.8832
TOFFALETI-MPM	40.21	0.729	0.8448
EINSTEIN(TOTAL-LOAD)	38.81	1.041	1.5765
LAURSEN(MADDEN),1985	34.27	1.065	1.5503
COLBY	31.12	1.217	11.2550
TOFFALETI.	29.02	0.511	0.7592
SCHOKLITSCH	19.58	0.992	4.2301
EINSTEIN(BED-LOAD)	12.94	0.349	0.8443
MPM(1948),D50	9.79	0.274	0.8270
MPM(1948).	8.04	0.230	0.8460
PARKER	0.70	0.018	0.9877

Table 5.20. Sediment Transport Function Rankings for RIO Data Set.

DATA SET: RIO		# DATA POINTS	IN SET: 38	
FUNCTION		Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
PROFITT(SUTHERLAND)		97.37	1.343	0.5688
ACKERS-WHITE.	2	94.74	0.861	0.3329
ACKERS-WHITE, D50		94.74	0.818	0.3245
VAN RIJN	1	89.47	1.013	0.4775
BROWNLIE, D50		86.84	0.729	0.3848
COLBY	3	86.84	0.731	0.4029
ENGELUND-HANSEN		65.79	0.706	0.4176
YANG.		63.16	0.567	0.4759
YANG, D50		63.16	0.579	0.4672
EINSTEIN(TOTAL-LOAD)		63.16	1.309	0.8508
TOFFALETI-SCHOKLITSCH		63.16	0.633	0.4708
TOFFALETI-MPM		63.16	0.622	0.4756
LAURSEN(COPELAND)		57.89	1.962	1.3509
TOFFALETI.		42.11	0.541	0.5399
LAURSEN(MADDEN),1985		39.47	0.508	0.5844
EINSTEIN(BED-LOAD)		2.63	0.177	0.8408
MPM(1948).		0.00	0.123	0.8904
SCHOKLITSCH		0.00	0.137	0.8794
PARKER		0.00	0.000	1.0134
MPM(1948),D50		0.00	0.140	0.8735

Data Ranges of the Data Sets used in SAM.aid

The data sets used in SAM.aid for comparison of user-input data each have a range of values for the five selection parameters: d_{50}, velocity, depth, width, and slope. These ranges are given in Table 5.22. However, in the SAM.aid program the upper and lower limits of the ranges for D_{50} have been extended to the next size class boundary, according to the American Geophysical Union standard size classes. This allows a somewhat wider range of choices to be offered to the user without compromising the theory behind SAM.aid.

Table 5.22. Data ranges of the data sets referenced in SAM.aid.

ACP			**AMC**		
D50	0.0830	0.3640	D50	0.0960	7.0000
SLOPE	0.0004510	0.0001358	SLOPE	0.0000580	0.0003300
VELOCITY	1.1445	4.2513	VELOCITY	1.3630	2.5167
WIDTH	112.9703	459.8822	WIDTH	10.4973	72.7812
DEPTH	2.4994	14.0965	DEPTH	2.6092	8.4978
ATC			**CHO**		
D50	0.0800	0.3033	D50	0.0900	0.3200
SLOPE	0.0000056	0.0000513	SLOPE	0.0000510	0.0002538
VELOCITY	1.0000	6.6000	VELOCITY	2.2000	5.3000
WIDTH	1000.0	1650.0	WIDTH	75.0000	400.0000
DEPTH	20.0000	50.0000	DEPTH	4.2000	12.0000
COL			**HII**		
D50	0.1550	0.6950	D50	0.210	1.440
SLOPE	0.0000370	0.0004070	SLOPE	0.0008400	0.0113000
VELOCITY	1.5561	4.1576	VELOCITY	0.47	3.05
WIDTH	303.8716	834.9249	WIDTH	1.14	26.25
DEPTH	3.7192	12.7566	DEPTH	0.06	2.4
LEO			**MID**		
D50	0.140	0.814	D50	0.2000	0.4500
SLOPE	0.0000533	0.0003460	SLOPE	0.0009000	.0016000
VELOCITY	1.19	4.14	VELOCITY	1.9000	3.7000
WIDTH	291.01	822.03	WIDTH	122.0000	153.0000
DEPTH	3.15	13.47	DEPTH	0.8000	1.4000
MIS			**MOU**		
D50	0.1629	1.1292	D50	0.2859	0.8992
SLOPE	0.0000183	0.0001336	SLOPE	.0013600	.0031500
VELOCITY	2.0000	8.0000	VELOCITY	1.2008	4.4326
WIDTH	1495.0000	3640.0000	WIDTH	10.7971	14.2165
DEPTH	15.0000	60.0000	DEPTH	0.1299	1.4366

NED			NIO		
D50	0.1000	1.0800	D50	0.2000	0.3600
SLOPE	0.0000030	0.0006200	SLOPE	.0011000	.0018000
VELOCITY	0.6507	5.3835	VELOCITY	2.0000	4.2000
WIDTH	88.5600	2771.5990	WIDTH	65.0000	75.0000
DEPTH	4.3296	43.5584	DEPTH	1.3000	2.0000
NSR			**OAK**		
D50	13.0000	76.0000	D50	8.2000	27.0000
SLOPE	.0015800	.0074500	SLOPE	.0097000	.0126000
VELOCITY	5.0000	11.0000	VELOCITY	2.6502	3.6719
WIDTH	9.0000	20.0000	WIDTH	13.8577	19.3976
DEPTH	2.0000	9.0000	DEPTH	1.0076	1.7256
POR			**RED**		
D50	2.2000	2.6000	D50	0.0900	0.2200
SLOPE	.0005400	.0009700	SLOPE	0.0000661	0.0000824
VELOCITY	2.0000	4.8000	VELOCITY	1.2000	3.8000
WIDTH	225.0000	620.0000	WIDTH	425.0000	600.0000
DEPTH	1.5000	8.0000	DEPTH	9.8000	25.0000
RGC			**RGR**		
D50	0.1800	0.2800	D50	0.1700	5.2000
SLOPE	0.0005300	0.0008000	SLOPE	0.0006900	.0024600
VELOCITY	2.6000	5.0000	VELOCITY	0.6000	8.0000
WIDTH	65.0000	75.0000	WIDTH	25.0000	400.0000
DEPTH	3.0000	5.0000	DEPTH	.5000	11.0000
RIO					
D50	0.2073	0.3676			
SLOPE	0.0007400	0.0008900			
VELOCITY	2.0481	7.8271			
WIDTH	132.9659	644.8348			
DEPTH	1.0896	4.7986			