

May 8, 2001

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TO: Members, AASHTO Task Force on Hydrology and Hydraulics
Officers, AASHTO Subcommittee on Design (Attachment A)

FROM: Secretary

SUBJECT: Minutes of the Spring Meeting, Topeka, KS

Attached are minutes of the meeting of the Task Force on Hydrology and Hydraulics held at the Courtyard Marriott in Topeka, KS on April 30-May 4, 2001. Corrections will be accepted prior to the next meeting. At the meeting, the task force members extended their appreciation to Jim Richardson for his handling of meeting arrangements and for setting up the field trip.

All members should check the minutes for action items which are identified with an * on the left margin.

Sincerely,

Philip L. Thompson, P.E.

Enclosures

AASHTO TASK FORCE ON HYDROLOGY AND HYDRAULICS

Minutes of Spring 2000 Meeting at Topeka, KS

Chair Bill Hulbert opened the meeting at 8 a.m. The following members were present unless noted absent (See attachment A for addresses):

<u>TASK FORCE MEMBER</u>	<u>STATE</u>	<u>JOINED</u>	<u>REGION</u>
B. Bailey	Wyoming	1994	4
J. Boynton	Minnesota	1998	3 (absent)
D. Bryson	Oregon	1994	4
S. Choudhary	Ontario	1998	3
G. DeCou	California	1994	4 (absent)
M. Dougherty	Indiana	1994	3
A. Fallahi	Utah	1997	4 (resigned)
D. Ghere	Illinois	1975	3
D. Henderson	North Carolina	2000	2
W. Hulbert, Chair	South Carolina	1992	2
D. Landry	Vermont	1997	1 (absent)
S. McLemore, Vice Chair	Florida	1992	2
M. Miles	Alaska	2000	4
R. Mills	Virginia	1999	2 (absent)
B. Newman	Pennsylvania	1997	1
F. Nishioka	Hawaii	1991	4
T. Ngo	Oklahoma	1991	4
L. Reese	Idaho	1996	4
J. Richardson	Kansas	1996	3
P. Thompson, Secretary	Washington, DC	1989	1
Duc minh Tran	Quebec	1999	1 (absent)
R. Veeramachaneni	Maryland	1997	1 (absent)

VISITORS PRESENT (see attachment B)

1. **MEETING SUMMARY**

MEETING AGENDA (See attachment C)

PAST MEETINGS (Minutes available from Secretary)

<u>YEAR</u>	<u>MEETING</u>	<u>ZONE</u>	<u>LOCATION</u>	<u>DATE</u>
2001	61-Fall	1	MD	October
2002	62-Spring	4	ID	May
2002	63-Fall	4	OK	October
2003	64-Spring	3	IN	May

2. **WELCOME AND INTRODUCTIONS**

- A. Chair Bill Hulbert welcomed the members of the task force and:
 - ! Thanked Jim Richardson for making the meeting arrangements.
 - ! Asked everyone to introduce themselves (see attachment B for visitors).
 - ! Noted that the meeting registration cost would be \$70.
- B. Jim welcomed the task force and introduced Warren Sick, P.E., Assistant Secretary and State Transportation Engineer, who has been with KDOT since he graduated in CE in ND in 1967:
 - 1. Warren Sick provided the following interesting facts and overview of KDOT accomplishments:
 - a. First, he noted his appreciation for the work of the task force.
 - b. They are 4th in the country with 134k miles of roads. KDOT is only responsible for 10k miles, but those miles carry about 52% of the traffic. They do not have many people supporting the highways with only 19 people in KS/lane mile (TX has 65 and CA has 191).
 - c. Transportation funds come from \$0.20/gal tax on fuel and 9% of general fund.
 - d. In 1988, a 10 year highway program for \$13.4B was started. About \$7B went to highways and \$2.7B went to locals. In addition \$3M went to 42% of airports that were participating and \$6M for public transportation.
 - e. TRIP report listed KS as the 7th best in the nation. KDOT spends \$29k/lane mi where the average in the US is only \$24k/lane mi. Neighboring MO only spends \$12k.
 - f. AP report on bad bridges listed KS as 3rd best and 22nd for structural deficient.
 - g. He challenged the task force to find ways to do job better.
 - 2. Jim discussed the field trip on Wednesday to visit a new NASCAR facility near Kansas City and construction near Topeka.

3. **BUSINESS MEETING ACTIVITIES (Monday & Wednesday)**

- A. Membership: Mark Miles of AK was approved on 4/30 by the SOD chair. David Stolpa of TX nomination is pending.
- B. Treasurer indicated that we will have a positive balance after expenses are paid.
- C. The chair or secretary discussed the following attachments:
 - A. Membership List
 - B. Visitors List
 - C. Agenda
 - D. HDG & MDM Status and assignments
 - E. Task Force Publication History
 - F. Scour Evaluations Progress Report
 - G. FHWA Technology Applications
 - H. FHWA NHI Training Activities
 - I. FHWA Publication List (not handed out)
 - J. FHWA Software List (not handed out)
- D. Handouts - The following items were provided before or at the meeting:
 - 1. NCHRP proposed projects for Hydrology and Hydraulics
 - 2. Status of revisions for 2003 HDG and MDM
 - 3. Final Draft for new 2003 MDM 18
 - 4. Corrections for 2003 HDG Volumes 2, 3, 9 and 13 and MDM chapters 13 and 15-19
- * E. Future meeting locations were discussed and sites selected (see page 1). The Fall 2001 meeting will be held in MD. The spring 2002 meeting will be held in ID. The Fall 2002 meeting will be in Oklahoma. The Spring 2003 meeting will be in Indiana.
- F. The following agenda items are proposed for the next meeting:
 - 1. Drafts of rewrites for 2003 HDG3 and MDM3.
 - * 2. Review of SOD review comments for HDG 15, Guideline for Hydraulic Design Consultants. Raja

will send out a corrected version by email.

- G. Reviewed guideline and MDM target dates. See attachment D which contains assignments for MDM chapters and HDG volumes. The chair made new assignments which are shown on attachment D.
- H. The following topics were previously suggested for future work of the task force: MS4 guidelines, workflow processing guideline, marketing, ground water hydraulics, hydroplaning.
- I. Election of officers was held. Vice Chair Shawn McLemore was elected unanimously to chair. Merrill Dougherty was elected unanimously to serve as vice chair.

4. **FHWA ACTIVITIES AND SCOUR EVALUATION PROGRESS REPORT**

Phil Thompson briefed the task force on the status of FHWA Technology Applications projects and NHI course development. (Some FHWA publications are available at isddc.dot.gov.)

A. The following is a summary of items discussed:

- 1. FHWA memorandum dated 4/27/01 Revision of Coding Guide, Item 113 - Scour Critical Bridges was handed out and discussed. The primary change was to code 7 and 8 to accommodate countermeasures that are assessed as safe.
- 2. HEC 24, Pump Stations, has been posted on the FHWA web site.
- 3. HIF Roadmap of proposed hydraulics activities from FY01 through FY 09 was handed out and other proposed activities was requested.

B. The overview of scour evaluations progress was prepared by Jorge Pagán. A handout was provided which indicated a Summary of Scour Evaluations Nationwide as of April 15, 2000 (Attachment F). Phil noted the following which is summary of 11/15/00 data:

- 1. Only 211 of 481,530 bridges over water have not been screened. Of bridges screened, 18.6% (89,611 bridges) have unknown foundations.
- 2. 92.4% (361,260) of 390,932 bridges needing evaluation have been evaluated for scour and 7.6% (29,672) still need evaluation.
- 3. 8 DOTs have completed 100% and 34 DOTs have completed more than 90%.
- 4. 10 DOTs have not completed 90% of their needed evaluations.
- 5. 20 DOTs have over 1000 bridges to evaluate if unknown foundations are included.

5. **NCHRP**

Timothy Hess, NCHRP Program Officer who handles hydraulics, geotechnical and roadside design, provided an overview of NCHRP projects related to hydraulics using transparencies. He provided handout of the presentation slides (some of the material below was provided at earlier meetings):

A. Background - TRB is a unit of the National Academy of Sciences which is the operating arm for the National Academies. TRB has 5 Divisions. The two divisions of most interest to the task force are Division A Technical Activities and Division D Cooperative Research Council. NCHRP started in 1962 and the Transit CRP started in 1992. NCHRP has 13 FTE that administers 157 active panels with 1039 panel members. The CRP homepage is www4.nas.edu/trb/crp.nsf

- 1. Financial support is from State DOTs which provide a 5.5% contribution from their State Planning and Research Federal-aid funds. The contribution is voluntary and comes through FHWA. The funding was \$3.5M in 1968, \$8.5M in 1991, \$15.3M in 1992 and \$17.7M in 1997. TEA21 increased funding to \$27M through 2003.
- 2. Division B synthesis projects are provided funds by SCOR through project 20-5 which is managed by Stephen Maher.

B. Problem Statements - Ideas come from States, AASHTO and FHWA.

- 1. TRB committees can submit statements through AASHTO subcommittees.
- 2. The two stage review process begins on June 1 with stage 1 problem statements, FHWA and NCHRP review the statements. The revised statements must be submitted to NCHRP by November 1 in order to be considered at the March SCOR meeting. Both Research Advisory Committee and

- SCOR rank projects and then a combined ranking is prepared.
3. Most awards go to industry, 45%, and universities, 36%. About 90% of projects are published.
 4. The task force should send proposed projects to: Robert J. Reilly, Secretary, Standing Committee on Research, TRB, 2101 Constitution Avenue, Washington, D.C. 20418. The letter should indicate which projects were selected from 24-8 list and should note "Projects on list were carefully considered and the following projects are the task force's highest priority."
- C. NCHRP Project Status Reports for Hydrology and Hydraulics
1. 21-5(2) Unknown Foundation Instrumentation - research has stopped, final report and guidelines will be published this summer. RFP for risk based guidelines will be advertised 6/01.
 2. 24-7(2) Countermeasures - \$450k Ayres will include partnering with states for field verification. Phase 1 report is available for loan. Phase 2 guidelines start 4/01 for 3 years.
 3. 24-14 Scour at Contracted Bridge Sites - \$500k Art Parola has interim report, complete late 2002.
 4. 24-15 Bridge Scour in Cohesive Materials - \$350k TX A&M, have interim report, complete 1/2002.
 5. 24-16 Channel Migration - \$550k Ayres will complete late 2002.
 6. 25-12 Wet Detention Pond Research - \$580k by David Young of WSU, draft final report due.
 7. 21-07 Development of Portable Scour Monitoring Equipment - \$300k Ayres, Jim Schall, started 4/00 and will be complete 11/2002.
 8. 24-8, Scour at Bridge Foundations Research Needs - FY 98 three projects were funded from list: 24-14, 24-15 and 24-16. No projects funded in FY 99 or 2000 and 3 in FY 2001.
 9. 15-23 Technical support for MDM and HDG - \$200k (see below)
 10. 24-18 Countermeasures to Protect Bridge Abutments - #12 on 24-8, \$450k, Brian Bartoff, MSU, has 3 year contract.
 11. 24-19 Environmentally Sensitive (Non-structural) Channel & Bank Protection - \$350k, John McCallum, Redding, CA (see Erosion draw and Biodraw software)
- D. NCHRP Projects for 2001 - 3 of 5 (60%) task force submitted projects approved. Overall success rate is 40% (20 of 51) for AASHTO Committees and 15% (6 of 66) for AASHTO members. Overall, 45 of 144 (35%) submitted projects were funded for \$17.2M plus 19 of 20 continuations for \$9.2M. Total funded was \$26.4M of \$58M requested. The approved hydraulics projects are:
1. 15-23 Technical support for MDM and HDG - (see below)
 2. 24-18 Countermeasures to Protect Bridge Abutments (see above)
 3. 24-19 Environmentally Sensitive (Non-structural) Channel & Bank Protection (see above)
- E. NCHRP Projects for 2002 - The task force voted on the following priority at Spring 2000 meeting and to submit the top six. The individuals listed will draft the problem statement by July 15 and submit to the chair. Number in bracket [#] is the number of votes received that this was a high priority project:
1. Effects of Debris on Pier Scour & Hydraulic Performance [14] - Phil
 2. Coordinated Update of Rainfall Maps [12] - have statement, Phil/Sterling
 3. Software Certification Protocol [9] - Saeed
 4. Riprap Specification (Design & Construction) [7] - Larry
 5. Drainage Design for Shoulderless Roadways [7] - Raja
 6. Scour in Rock at Bridges [6] - #13 on 24-8, have statement - Phil
 7. Effects of Riprap on Fish Habitat [6]
 8. Time Rate of Scour at Wide & Skewed Bridge Piers [6] - #8 on 24-8, have statement
 9. Roughness Coefficients for Culverts [6]
 10. Criteria for Selecting Hydraulic Models [4]
 11. Time of Concentration for Pavement Drainage [3]
- F. NCHRP Projects for 2002 - The chair sent the following problem statements to Tim Hess of NCHRP with a copy to Ken Kobetsky on August 18, 2000:
1. Effects of Debris on Pier Scour at Bridges - prepared by Phil Thompson and Dr. Art Parola based on #14 of 24-8
 2. Coordinated Update of Rainfall Maps in U.S. - prepared by Sterling Jones and Will Thomas

3. Software Validation and Certification Protocol for Hydrologic and Hydraulic Models for All Aspects of Storm Drainage - prepared by Bill Hulbert and Saeed Choudhary
4. Riprap Design Criteria, Specifications and Quality Control - prepared by Dr. Larry Arneson
5. Effects of Fractured or Degradable Rock on Pier Scour at Bridges - prepared by Phil Thompson and Dr. Joe Haggerty based on #13 of 24-8

G. NCHRP Projects for 2002 - None of the above submitted projects were funded.

1. 24-20 Prediction of Scour at Bridge Abutments that was submitted by AZ was funded. This project which was similar to 24-8 project 5 was funded for \$500k
2. SCOR funded \$14.6M (28 out of 147) new projects and \$9M, 20 project continuations, for a total of \$23.6M. The total requested was \$63.3M for 167 projects.

H. NCHRP Projects for 2003 - The chair identified the following proposed problem statements for consideration at the next meeting and then identified the listed people as drafters. The statements should be drafted and sent to the chair by April 1st:

1. Effects of Riprap on Fish Habitat - Dave Bryson
2. Time Rate of Scour at Wide & Skewed Bridge Piers - #8 on 24-8, Phil Thompson/Jorge Pagán
3. Roughness Coefficients for Culverts - Saeed Choudhary
4. Criteria for Selecting Hydraulic Models (1D/2D) - Shawn McLemore
5. Integration of Water Quality and Drainage Structure Design - Raja Veeramachaneni/Dave Henderson
6. Long Term Performance of BMPs - Barry Newman/Raja Veeramachaneni

I. NCHRP Projects 2003 - Problem statements were developed for H1-4 and provided to the task force before the meeting. Since H5 and H6 were not prepared they were deferred.

- * F2 above was tabled since a nationwide study may be starting. In addition, Jim McDonald recommended submitting F3 to SCOH for consideration of project 20-7. Tim Hess agreed to provide project to Crawford Jenks. In addition, chair will submit by letter if needed.

The remaining projects H1-4, F1, F4 and F5 were balloted and the following priority order was agreed to and will be submitted by the chair in August:

- * 1. Riprap Design Criteria, Specifications and Quality Control - prepared by Dr. Larry Arneson who agreed to update and include reference to 24-18 and 24-7(2).
- * 2. Develop Hydraulic Loss Coefficients for Culverts - Saeed Choudhary who agreed to update based on discussion at the meeting
3. Effects of Debris on Pier Scour at Bridges - prepared by Phil Thompson and Dr. Art Parola based on #14 of 24-8
4. Criteria for Selecting Hydraulic Models (1D/2D) - Shawn McLemore
5. Effects of Fractured or Degradable Rock on Pier Scour at Bridges - prepared by Phil Thompson and Dr. Joe Haggerty based on #13 of 24-8
6. Effects of Riprap on Fish Habitat - Dave Bryson
7. Time Rate of Scour at Wide & Skewed Bridge Piers - #8 on 24-8, Phil Thompson/Jorge Pagán

J. NCHRP 15-23 Technical support for MDM and HDG, \$200k (Tim Hess, project manager) - Task force panel is Bill Hulbert (chair), Phil Thompson, Dave Bryson, Shawn McLemore, Roy Mills, and John Boynton.

1. At the 5/01 meeting, Roy Jorgenson PI, Ken Shearin, and Don Potter provided a handout and discussed their vision of the project. The following items were discussed:
 - a. P2, 1A3 - Don will do all conversions and accuracy consistent determinations.
 - b. P3 - Peter Smith will provide independent review of both HDG and MDM.
 - c. P4 - Units will generally be kept as used in manual. Ken gets "US Metric Association Newsletter" which indicates that only about 10 states are primarily SI.
 - * d. P7 - Don will rerun all problems with new versions of programs. Joe Krolak agreed to provide Don with a Windows version of HYDRAIN.
 - e. P8 - Word 97 to Word 2000 conversions are better than earlier conversions.

- f. P8, 8D3 - agreed to use one column in HDG with small figures on right of text wrapped left.
- g. P9 - DGN microstation format graphics will be converted to EPS or DXT format so that they can be read into Word.
- h. Agreed to use the following: 11 pt, Arial with 1.1 line spacing, block letters in equations, margins left and right will be 1", margins top and bottom will be tried at 0.75", line numbers will be used down margin for the draft, and that lines in margins will be considered to indicate where major changes have been made.

6. **AASHTO HIGHWAY DRAINAGE GUIDELINES**

A. See attachment D for status. [Guideline development time is at least 30 months: 6 months for a draft, 6 months for a table review, 6 months for SOD review, 6 months for SOD ballot, and 6 months for SCOH ballot.

B. HDG, Edition 3, Metric Conversion

- * 1. The chair previously send a letter to AASHTO and requested that HDG and MDM be provided to the States in electronic format and on CDROM. The chair will check the status of the request.
- 2. The secretary received PDF files for all volumes except 7.

C. HDG 2003, Edition 4, Updates and Revisions - The task force initiated this revision project in 1997 to prepare an updated version of the metric Edition 3. While all volumes will be reviewed, volumes 4-7 were given highest priority for a future table reading, because they are the oldest.

1. Accomplishments to date:

- a. Fall 1997, volume chairs identified editorial corrections and sections which should be updated.
- b. Spring 1998, secretary handed out a consolidated list of comments. The list was updated after the meeting and emailed to the task force.
- c. Fall 1998, revised sections were handed out at the meeting for volumes 4, 6, 7, and 9.
- d. Fall 1999, secretary handed out a consolidated list of comments.
- e. Spring 2000, revised sections were handed out at the meeting for volumes 1, 8 and 10.
- f. Fall 2000, consolidated list of comments provided by email after the meeting.
- g. Spring 2001, revised sections were handed out at the meeting for volumes 2, 9 and 13.

2. Actions needed:

- * a. Volumes 3 and 11 need to have material drafted.
- b. The definition of "guide" and "guideline" on page 40 of the glossary should be combined. The AASHTO supplied definition of a guideline is: "Guidelines - Provides direction, illustrates established practices and is intended to form a comprehensive reference manual for assistance in administrative, planning, "design," and educational efforts in a particular area." Note: "design" added by the task force to definition provided by AASHTO staff.

3. The status of all volumes is listed below. The volume chairs need to complete their review and drafting for the volumes indicated with an "*".

- I. Planning (Danny Landry) - review is complete, corrections read 5/00
 - page 16, new reference added
 - page 18, DEM discussion from USGS added
 - page 21, reference 3 updated and reference 8 added
 - page 21, 1994 green book is correct for now, but 2000 version is being prepared.
 - page 23, delete field visit form, move to MDM

II. Hydrology (John Boynton) - review is complete, corrections read 5/01.

- * III. Erosion & Sediment (Dave Henderson) - corrections complete 5/98, revisions pending
 - Material will be drafted for the next meeting.

- IV. Culverts (Phil Thompson) - corrections complete 5/98, revisions complete 10/98
 - V. Legal (Jim Richardson) - corrections complete 5/98, revisions complete 10/98
 - Secretary sent PDF file 10/20/00
 - VI. Channels (Dave Bryson) - corrections complete 5/98, revisions complete 10/98
 - 10.3 Impermeable channel linings received a table reading 10/00
 - 9.4 Vegetative Streambank stabilization received a table reading 10/00.
 - VII. Bridges (Roy Mills) - corrections complete 5/98, revisions complete 10/98
 - VIII. Restoration (John Boynton) - corrections complete 5/98, revisions read 5/00
 - John provided handout of corrections and draft of new material was read.
 - References 10 & 11 formatting style should be resolved.
 - Section 2.2 refer to legal chapter, delete sections 2.2.1-6
 - Add "Considerations" to sections 2 and 5
 - IX. Storm Drains (Bill Bailey) - corrections complete 5/98, revisions read 5/01
 - Bill discussed option of including hydrographs and read a draft discussion on hydrographs which was prepared for the MDM. A survey of those present indicated that no state is now using hydrographs as their standard and so option was rejected 11/99
 - Discussion on controlling outfalls prepared for MDM 13 needs to be adapted to HDG.
 - Section 5.6 read 5/01, reference needs to be added to HDG 12.
 - Water quality issues in underground disposal need to be addressed.
 - X. Environment (Te Ngo/Mark Miles 5/01) - corrections complete, revisions read 5/00
 - File of corrections emailed before the meeting.
 - Agreed to use lowercase l for mg/l and retain most footnotes.
 - Dennis Stuhff provided corrections to Te which were incorporated in 12/00 draft.
 - * XI. Coastal Zone (Shawn McLemore) - corrections complete 5/98, revisions complete 10/00
 - Draft section 5.4 provided 10/00
 - Replacement figure for 14-20 from FEMA study on erosion rates
 - Checked devices against chapter 17, HDG has one additional retarts
 - Comment #136, delete #10
 - * - At 5/01 meeting Bill Hulbert agreed to check into having pool funded project fund updates to this volume. Dr Billy Edge identified that this volume was out of date.
 - XII. SWM - New, no changes
 - XIII. Training - New, no changes
 - XIV. Culvert Rehabilitation - New, no changes
- D. HDG Volume 15, Guidelines for Selecting and Utilizing Hydraulic Engineering Consultants - The drafting team is Veeramachaneni (leader), Newman, and Richardson.
1. The following background information was identified:
 - a. MD and VA have detailed RFP for on call consultants.
 - b. OR has a guideline for what they would like to receive from a consultant.
 - c. SC has design/build guidelines and Bill Hulbert provided a copy to Barry.
 - d. FL has prequalification procedures, but not for hydraulic consultants.
 - e. The training guideline should be referred to.
 - f. TX procedures are at: "www.dot.state.tx.us/insdtdot/orgchart/des/continfo/precert.htm"
 - g. The team has reviewed the guidelines produced by the Task Force on Preconstruction Management and Raja has a copy.
 - h. Bill provided SC evaluation document.
 - i. Dave provided OR guidelines for bridge reports.
 - j. Phil provided FHWA CORE competencies to Raja, Bill and Shawn after the meeting.
 2. The proposed outline of the guideline was approved at the fall 1998 meeting. At that meeting, it was decided to:
 - a. Reference the AASHTO consultant document and reduce the size of section 1.

- b. Reference ACEC joint group 1996 document and planned update.
- c. Gary Croskey agreed to provide score sheet for prequalifying hydraulic qualifications.
- d. Consider including a sample list of qualifications to use for an RFP.
- 3. The drafting team prepared a revised outline.
- * 4. A draft was read at 10/2000 meeting. The task force agreed to include checklists. The very well written draft received minor editing at the meeting. The task force adopted the draft and voted to send it to SOD for review by Jan 15, 2001. Since review draft was not completed, SOD review was deferred until summer 2001.

7. **MODEL DRAINAGE MANUAL (MDM)**

A. Metric Edition 2 (1999 MDM)

- 1. The text of all chapters was updated and graphics converted to TIF format by Dr. Tom Debo. The graphics were integrated into the WP 6.1 files by TTI. The task force final review was completed on April 2, 1998. On June 30, 1998, TTI sent deliverables to NCHRP who sent to AASHTO by letter dated July 8, 1998.
- 2. 7E Wetlands Hydrology - The Water Budget, distributed February 2000.
- 3. 15G Wetland Creation and Restoration, distributed February 2000.

B. Edition 3, (2003 MDM)

- 1. Accomplishments to date:
 - a. Fall 1997, leaders identified editorial corrections and sections which should be updated.
 - b. Spring 1998, secretary handed out a consolidated list of comments. The list was updated after the meeting and emailed to the task force.
 - c. Fall 1998, revised sections have been emailed or handed out for chapters 2, 6, 8, 9, and 10.
 - d. Fall 1999, secretary handed out a consolidated list of comments.
 - e. Spring 2000, revised sections were handed out for chapters 6, 17, 18, 20 and 21.
 - f. Fall 2000, consolidated list of comments provided by email after the meeting.
 - g. Spring 2001, revised sections were handed out for chapters 13, 15-19.
- 2. Actions needed:
 - * a. The task force voted to request that the 2003 MDM be produced in English units only. The chair requested an exemption from the SOD chair by letter on 9/25/00.

C. Edition 3, (2003 MDM), Status by Chapter:

- 1. Introduction (Phil Thompson) - corrections complete 5/98, revisions complete 10/98
- 2. Legal (Jim Richardson) - corrections complete 5/98, revisions complete 10/98
- 3. Policy (Francis Nishioka) - corrections complete 5/98
- 4. Documentation (Glenn DeCou) - Glenn indicated chapter is current 5/99
- 5. Planning (Danny Landry) - review and corrections complete 10/00
 - a. Introduction added and "Stormwater Management Title" revised.
 - b. Section 5.1.1 revised.
 - c. Revise section on permits.
- 6. Data Collection (Lotwick Reese) - corrections complete 5/98, revisions complete 5/00, revisions update handout provided and read 10/00 by Lotwick.
 - a. Lotwick and Raja read a new section on data accuracy 5/00.
 - b. Parts of 6.5 draft of 5/00 should be moved to Ch 8 Channels.
- 7. Hydrology (John Boynton) - revisions complete 10/00
 - a. John provided and read proposed revisions 10/00.
 - b. Agreed to delete sections 7.13 and 7.14, 10/00
- 8. Channels (Dave Bryson) - corrections complete 5/98, revisions complete 10/98
- 9. Culverts (Phil Thompson) - corrections complete 5/98, revisions complete 10/98
 - a. Handed out proposed table for step 1 of design procedure which listed design criteria by two

- alternate levels of design: major and minor.
- b. Voted against using material by small margin, but later decided to revisit at future meeting.
- 10. Bridges (Roy Mills) - corrections complete 5/98, revisions complete 10/98 Calvin emailed files of proposed revisions to task force members after the meeting. Calvin handed out the revised chapter and did a table reading of the new material which was adopted. New material was shown in the chapter in bold.
- 11. Energy (Phil Thompson) - corrections complete 5/98, revisions complete 10/00
 - a. Handed out proposed addition on HY8Energy output 5/00.
 - b. Agreed to include HY8Energy output.
- 12. Storage (SWM) (Merril Dougherty) - corrections complete 5/98, revisions complete 5/01
Merril recommends tabling BMP discussion until next edition.
- 13. Storm Drains (Bill Bailey) - corrections complete 5/98, revisions read 5/01
 - a. Fall 99, Bill handed on proposed section 13.6.3 Other Methods. This draft included discussion of the Santa Barbara Urban Hydrograph (SBUH) and hydrographs is general. Of the States present, only WY and SC have used hydrographs for design. The task force voted to table the discussion of hydrographs.
 - * b. 13.5.7 Outfall policy was read 5/01 and accepted with corrections. Bill will edit.
 - c. 13.15.1 EGL and HGL redraft was read. The 1st 3 paragraphs will be kept as an introduction. The other material will be considered for different sections, 10/00.
- * 14. Pump Stations (Dan Ghere) - corrections complete 5/98, revisions complete 10/00
 - a. Arlo provided the file of the draft FHWA HEC on pump stations to Dan.
 - b. Corrections include material from HEC 24
 - c. Phil provide the file of HEC 24 for figures 2-1 and 3-5
 - d. Phil checked with Bob Baumgardner for source of figure 14-5
- * 15. Environment (Te Ngo/Mark Miles from 5/01) - review complete 10/00, revisions read 5/01
 - a. NPDES Phase 2 discussion was included by Te.
 - b. Bill Hulbert and Te have integrated 15G into the chapter.
 - c. Te read draft material 5/01 and provided revised chapter.
 - * (1) Fix policy chapter p3-8 section 9 on floodplains
 - (2) Phil will check Environmental Guidebook for Mitigation of Env. Impacts to Wetlands
 - (3) Te proposed and Mark Miles accepted to be new chair. Te will chair chapter 19 & 20
- 16. Erosion & Sediment Control (Dave Henderson) - corrections complete 5/98, revisions read at 5/01 meeting. Dave made the following observations at 10/00 meeting:
 - a. SCS needs to be changed to NRCS.
 - b. VA confirmed that 1980 VA E & S manual is still valid.
 - c. Burlap silt fence will be deleted.
 - d. References will be checked.
 - e. Structural controls require more maintenance.
 - f. Other ditch linings will be added.
- 17. Bank Protection (Bill Hulbert) - corrections complete 5/98, revisions read 5/01
 - a. Bioengineering material needs to be added. Raja agreed to provide "Guidelines for Waterway Construction in MD" in electronic format to the secretary for distribution.
 - b. Bill handed out 5/00 editorial mark up.
 - c. Need bendway weir and countermeasure discussion.
 - d. Add 2T to bottom of figure 17-14.
 - e. Bill read a new bendway weir section 17.7.8, 5/01.
- 18. Coastal Zone (Shawn McLemore) - corrections complete 5/98, Bill Hulbert arranged for the tidal pooled fund study to have Ayres/Dr. John Fisher and Dr. Billy Edge prepare this chapter:
 - a. A draft was discussed at 10/00 meeting. The following was decided:
 - (1) Desirable to include design procedures, illustrated with example problems.

- (2) Agreed to reference web sites in the text.
- (3) West coast (winter storms) and tsunamis will be discussed.
- (4) 18.5.3 add example of Hudson equation.
- (5) Show ACES output for worked examples and include boundary conditions with Surge.
- b. Task Force reviewed draft and provided comments to Bill Hulbert by 12/1. Consolidated list of comments were provided to Dr. Billy Edge that were dated 12/14/2000. Dr. Edge handed out copies of the comments and a new draft at the May 2001 meeting and highlighted major changes. He invited another reading of the draft so that all editorial corrections are identified. It was agreed that this version be produced in SI units to agree with NCHRP first task to make all MDM corrections in 1999 SI edition; that references should be numbered and identified in the text; an appendix needs to be added to list software availability and the following changes should be made:

- * (1) p18-4, Bill Bailey needs to add definitions to glossary.
- * (2) p18-9, 18.1.5 & 2 added, 18.3 reduced, but file of material was saved for HDG.
- * (3) p18-16, Shore Protection Manual (SPM) is no longer available and is being replaced by new Coastal Engineering Manual (CEM). Phil agreed to see if FHWA could make old and new manuals available to DOTs. **[Note: check “Pile Buck” on web for SPM and other manuals that are available on CDROM.]**
- (4) p18-19, add USGS web site for datum conversion software and add conversion example from Ayres report.
- (5) p18-23, add example of extra-tropical storm (see Mark Miles).
- (6) p18-32, 18.4.5 - SBEACH costs about \$495 from contractor, FL has DNR software.
- (7) p18-34, add Dean and Dalrymple (1991) reference as alternate to SPM.
- (8) p18-37, add Corps EM web site.
- (9) p18-40, agreed to leave fig 18.13 in as an example & not include all 10 figures.
- (10) p18-54, move ACES discussion before where it is referenced in the text.
- (11) p18-58, 18.8.2 - reference maps from FEMA/state/others.

19. Construction (Mark Miles/Te Ngo 5/01) - review complete 5/01, revisions read 5/01

- a. 19.3 - Add temporary fill discussion in relation to FEMA. Dave Bryson indicated that temporary is considered 1-year or less in OR.
- b. 19.5 - Add what to expect during on site visits by EPA.

20. Maintenance (David Stolpa 5/01) - review complete 5/00, corrections read 5/00

- a. Fig. 20-1, efficiency of sediment basins needs to be revised.
- b. 20.3.4 - delete 1st sentence, move “detention facilities” to 2nd sentence.
- c. 20.5.2 - delete sentence “A permanent ... very expensive.”
- d. 20.5.3 - refer to culvert rehabilitation guidelines, HDG 14

21. Restoration (John Boynton) - review complete, chapter deleted 5/00

- a.. Raja noted that upgrading should be addressed in every chapter.
- b. Dan provided IL design exception policy and the secretary distributed.
- c. 5/00 voted to remove chapter 21 since all material is in HDG 8.

- * Glossary (Bill Bailey) - review pending - Bill requested that each chair check their chapters for possible additions to the glossary.

8. **STATEMENT OF NEED (SON), STANDARDIZED DATA LIBRARIES AND SOFTWARE FOR INTEGRATED ROADWAY AND DRAINAGE DESIGN (CADD, GIS, DEM).** The drafting team is

McLemore (leader), Bryson, Ngo, and Bailey. The SON product is intended to be a file transfer protocol. The task force should identify the data that all roadway design packages should provide, identify the file format (ASCII or other) and establish codes to identify groups of data.

A. Background/Past Activities

1. Peter Smith forwarded the final SON to the secretary on July 11, 1996. Calvin wrote to SOD chair and received approval to forward to AASHTO. He received letters from Jack Stanton, who coordinates AASHTOWare. Mr. Stanton recommended sending the SON to the Task Force on Joint Development for publication and identifying a funding source for an expanded SON.
 2. Leader contacted the IGRDS chair Dan Buhler, 204-945-3875 (IGRDS is no longer supported)
 3. Shawn McLemore discussed the AASHTO, Pavement Deflection Data Exchange, April 1998, Technical Data Guide 1.0. The task force agreed to use this as a model for storm drain data.
 4. At the spring 1999 meeting, Calvin provided a copy of "Engineering and Survey - Exchange (EAS-E), A Standard Engineering Data Format, Technical Draft," prepared by a Joint -Industry Consortium on July, 1998 (current revision April 17, 1999). Shawn noted that EAS-E uses ASCII format and key words, that industry reps were included on the drafting group. EAS-E was submitted to the Task Force on Joint Development, but rejected. Raja noted that he believes that protocols should be vender driven. No further action will be taken on developing protocols for hydraulic data (10/00).
 5. Gregg Herrin of Haestad said that LandXML (www.landxml.org) will include hydrology and hydraulics. Information is available on XML standard at www.aecxml.org.
- B. National Transportation Product Evaluation Program (NTPEP) was discussed at the Spring 2001 meeting in Topeka, KS by David Megger, KDOT, who is member of NTPEP Oversight Committee and chair of the HDPE NTPEP product evaluation committee:
1. The NTPEP pools professional and physical resources of AASHTO members. They test materials of common interest against existing standards and provide a one-stop shop report.
 2. Products proposed for testing in 2001 are HDPE, rolled erosion control products, and geotextiles. Future tests could be PVC pipes and geocomposites.
 3. The NTPEP process was recommended by President Tom Warne by letter after meeting with the Task Force and hearing of the need for software validation and certification.
 4. The standard NTPEP has the following steps: (a) create committee to guide product testing (task force would have to provide testing protocol), (b) NTPEP staff would collect fees and administer program, (c) test products and (d) publish results.
 5. For the task force proposed project of software certification, he recommended using "validation" rather than certification. He indicated that manufacturers sit on NTPEP committees. He noted that there is no funding from NTPEP. Funding will have to come from firms to be evaluated, pool funded project or from other sources. He asked the following question:
 - a. How do vendors feel about being tested?
 - b. What about effect on small 1 to 2 person firms?
 - c. Since NTPEP uses established standards, what exists for software? Can task force establish minimum requirements?
 6. The chair will receive description of NTPEP process form AASHTO staff.

9. **FIELD TRIP**

On Wednesday, the task force toured the following:

- A. Kansas Speedway - Eric Keenan of HNTB guided us through the construction site of the new 1.5 mile tri-oval speedway which is nearly complete at a cost of \$300M. He provided the following interesting facts: the site will accommodate 75K seats and 55 suites, 11 M cy of excavation was needed on the 1300 acre site, the track has 15 degree banking on curves, that 6 mile of pipe was used at the site, and the site is drained by a 96" pipe which discharges into a detention basin. Jim indicated that there is a small RCB outfall and that the detention basin had to be enlarged by excavating the 7' of sediment that had accumulated and checking design for MPF. Jim also indicated that about \$35M in highway improvements were needed to move the highway and add lanes. Eric said the track will open June 2nd with an Arca race, July 7th will be IRL race, and first NASCAR Busch and Winston cup race will be Sept 28. We visited the in field by driving through the 40' CONSPAN structure under the speedway. The fence

around the speedway is 15' high and has 0.75" cables which are above the 1' thick walls.

- B. Highway construction - Jerry Younger, Metro Engineer and former task force member, discussed construction of a major interchange, a high speed round-about and a toll plaza.

10. **TECHNOLOGY PRESENTATIONS**

- A. Hydrology Manual & HYDRAIN Revisions - Joe Krolak, Eastern Resource Center Hydraulic Engineer, provided a handout of his Powerpoint slides and discussed:
 - 1. HDS 2, Highway Hydrology, updates are underway by Greenhorne & O'Mara to convert the manual to dual units. He indicated that manual will be reorganized so that material like urban effects will be found with appropriate procedure. Manual should be complete this year.
 - 2. NHI 135067, Practical Highway Hydrology, will also be updated and include discussion of advanced models, wetland hydrology, and snow melt hydrology. Course pilots are planned for late October 2001.
 - 3. The draft Bulletin 17B can be downloaded from http://www.floodmaps.net/mit/tsd/DL_flow.htm. When final it will be available at FEMA Flood Hazard Website at <http://www.fema.gov/mit/tsd/>.
 - 4. HYDRAIN - He provided an overview of HYDRAIN and indicated that the 1996 version 6.1 is being updated with errors being corrected. He focused on the corrections to HYDRA and differences between HEC 22 junction loss procedure and HYDRAIN's. HEC 22, hand procedure, should be limited to simple, in line junctions. New version 6.2 should be available by late summer 2001. He provided another handout which included a flow chart and figures which illustrated an approach for handling supercritical flow. He offered to assist states in obtaining GKY Windows version of HYDRAIN. [Note from secretary, new dual unit HEC 22 will discuss the differences in procedures.]
- B. Revisions to HEC 18, HEC 20 & HEC 23 and Updates to NHI Courses - Dr. Pete Lagasse provided a handout of his transparencies and discussed the following:
 - 1. HEC 18 is complete and will be printed this month. Circular is reorganized by topic and includes new material for coarse bed material adjustment, complex pier foundations, pressure flow scour and new Item 113 guidelines. New appendices include cohesive soils and abutment scour alternatives.
 - 2. HEC 20 has been printed and will be distributed later this month. New material includes stream reconnaissance, classification & response; rapid assessment method; and quantitative analysis techniques. Countermeasure material has been moved to HEC-23.
 - 3. HEC 23 has been printed and will be distributed later this month. New material includes Plan of Action, instrumentation and monitoring, and new design guidelines for grout filled mattresses, modular concrete armor units and HEC 11 revetment guidelines.
 - 4. NHI 135046 will be updated and focus on HEC 18 & 20. A new 3-day course NHI 135048, Countermeasure Design, will be developed to teach HEC 23. Some equipment from completed DP 97 will be included. NHI 135047 inspectors course will also need updating. He handed out the new course objectives for 135046 and 135048. New manuals will be used for AZ course in June. New courses should be available by summer 2002.
 - 5. HIRE manual and course revisions are underway. The manual, new HDS 6, will have expanded sediment transport chapter which includes a design procedure to be consistent with other FHWA design guidelines. HIRE will be better integrated with HEC 18, 20 & 23, will include a level 3 analysis example using BRI-STARS.
- C. NCHRP 24-16, 24-07(2), 21-07 - Dr. Pete Lagasse provided a handout of his transparencies and updated the status of the projects:
 - 1. NCHRP 24-16, Methodology for Predicting Meander Migration - The handout contained a project schedule and a summary table of the 99 streams/1637 bends/2844 data points. The project is to develop a practical methodology to predict the rate and extent of channel migration. The Brice classification will be used and the data will be grouped by type. No regionalization will be attempted.

- The final database will be available on CDROM and will include Photo/Map Comparison Handbook and GIS (Arcview) software to estimate the rate of migration. He will be requesting states to test the guidelines and software. The project lasts until July 2003.
2. NCHRP 24-07(2), Countermeasures to Protect Bridge Piers from Scour - The project is a continuation of Phase 1 work done by SAF. The objective of the project is selection criteria, guidelines and specifications for design & construction, and guidelines for inspection & maintenance. The project just started and will last through September 2004. He will be sending out a letter this summer to bridge owners. After discussion with the States present, it was determined that they will have to know very soon if a project is to be installed in July 2002.
 3. NCHRP 21-07, Development of Portable Scour Monitoring Equipment - The objective of the project is to develop improvements and/or alternatives to existing portable scour monitoring equipment. The project will improve an articulated arm developed by FHWA.
- D. Lag Times of Rural and Urban Watersheds in KS - Dr. Bruce McEnroe, a professor at UK since 1987, provide a handout of his Powerpoint presentation and discussed the results of two KDOT research projects. He defined lag time and peaking coefficient, $Q_p = C_p V / T_p$. The peaking coefficient, C_p , governs the shape of the Snyder UH. Lag time is estimated as $0.6T_c$ (Kirpich's formula from 1940 from a farm in TN). Since lag time is measurable, it would be better to determine directly. They used 21 USGS stations that were matched with rain gages to identify 200 significant events. They found that lag time does not change with discharge. A regional analysis of data identified the following formula for Lag time = $.086[L/SQR(S)]^{.64}$ for rural watersheds with an average $C_p = .62$ (.46 to .77). For urban watersheds, they found that all urban watersheds have very short Lag times in the order of 5 minutes. A regression analysis was done which included IA (impervious area ratio) and RD (road density which is length of roads/drainage area). They found Lag time = $.106\{[L/SQR(S)]^{.64}\} \exp(-0.1RD)$ or Lag time = $.058\{[L/SQR(S)]^{.64}\} \exp(-3.5IA)$. Both work, but IA is better for small areas. He also noted that special situations can affect lag time. KS watersheds are less peaky than SCS hydrograph.
- E. Using NEXRAD Precipitation Estimates for Hydrologic Analysis - Dr. Bryan Young, an assistant professor at UK, provide a handout of his Powerpoint presentation and discussed the results of his KDOT research projects to determine if 125 NEXRAD (Next Generation Weather Radar) sites could be used to estimate precipitation for select events. The study started in 1995 and has archived NEXRAD precipitation estimates for KS. NEXRAD data has continuous spatial coverage of hourly data on a 4x4 km grid. The data that is most available is multi-sensor data (radar estimate merged with rain gage data) that is available from NWS River Forecast Centers. The data is hard to calibrate since it is hard to determine which gages were used. Also, data is related to polar stereographic map projection and has to be related to a grid through GIS. The GIS allows for storm visualization, contouring of precipitation, and computing averages. NEC-HMS will accept NEXRAD data. He concluded that continuous simulations is difficult, but good result can be obtained for an event on a large watershed. NEXRAD data can be found at www.ncdc.noaa.gov/ol/radar/radarsources.html.
- F. Sheet Pile Drop Structure/Energy Dissipator - Brad Rognlie, KDOT, discussed using Powerpoint slides, his design of KDOT project 156-42K6644 which is located in Hodgeman County, 4 miles east of Jetmore, in Buckner Creek drainage. The existing structure, 5 cell RCB (8' x 5'), was built in 1927 with a paved apron. Downstream 90' is a timber RR structure. In 1939, the culvert was extended 10' upstream. In 1966, an SCS pond was constructed 1.4 mi upstream and controls about 60% of the watershed. A 12' drop at the end of the apron developed from channel degradation probably due to the construction of the dam upstream. Maintenance in 1958 constructed a 6' sheet pile cutoff at the end of the apron. In 1968, they added asphalt to control the degradation. The hydrology for the 5.8 sm drainage area indicates that $Q(25, 50, 100)$ is 1310, 1800, 2370 cfs respectively. If the upstream fields are plowed, the discharge can be 1.4 times higher for Q_{100} . Brad reviewed USGS channel stages and determined that the channel is a stage 4 (less degrading & more widening). He compared channel profiles starting with 1927 and determined that future degradation could be as much as 6'. He considered sheet pile cutoff, broken back extension, heavy riprap, and gabions. The most cost effective was a straight drop basin designed with

HEC 14. At Q100, the velocity out of the culvert is 25 fps and out of the basin at 7 fps. The basin was constructed with a perimeter of sheet piles and a concrete floor. The floor (baffle blocks) were not included. A line of sheet piles was also constructed downstream of the RR structure. He showed a recent photograph of the site which showed that the channel appears stable in the vicinity of the energy dissipator. The countermeasures cost \$164K.

- G. SMS and WMS Updates and Other Interesting Topics - Dr. Larry Arneson demonstrated new features of each package and provided an overview using Powerpoint slides:
1. WMS - He demonstrated using new WMS 6.1 various ways to compute T_c & lag time, and weighted C for SCS curve number. He noted that data module is under development.
 2. NHI 135080 - He demonstrated the interactive software for presenting the course remotely.
 3. SMS - He demonstrated using new SMS 7.1 the new 3-D screen plotting and rotation feature using I-35 crossing of Cimarron River. A 1-D model interface and cross section data manager (CSDM) have been added. Interfaces have been added for UNET, BRI-STARS and a generic model interface to produce standard file formats. A new password procedure is being developed so that registration can be done by Internet.
- H. Research Topics - Sterling Jones used a Powerpoint presentation to discuss the status of projects:
1. Completed in the printing process
 - a. Abutment Scour for Compound Channels (FHWA-RD-99-156)
 - b. Effects of Gradation & Cohesion on Bridge Scour (FHWA-RD-99-189)
 - c. Debris Loading to Highway Structures (FHWA-RD-97-028), available at USGS web site
 2. Completed and printed
 - a. BRI-STARS (FHWA-RD-99-191)
 - b. Scour Instrumentation and Deployment (FHWA-RD-99-085)
 - c. Remote Methods for Underwater Inspection (FHWA-RD-99-100)
 3. Ongoing
 - a. Extrapolation of laboratory model scour results to field conditions - Dr. Max Sheppard, Univ. of FL, is conducting at Turner's Falls, MS.
 - b. FESWMS - Dr. Dave Froehlich is completing the users manual.
 - c. Performance of bridges during floods - Dr. Dave Mueller is producing the final report. This FHWA/USGS project will be merged with NCHRP 24-14.
 4. FHWA Hydraulics Laboratory
 - a. Complex Pier Scour - In partnership with Dr. Max Sheppard, Univ. of FL, developed new HEC 18 section.
 - b. Scour & Scour Protection of Bottomless Culverts
 - c. Culvert Entrance Studies for SD, IA, FEMA - The Iowa culvert entrance was an improved inlet made from standard shapes (a reducer to transition the area and two 22 degree elbows to provide a drop). The entrance loss K_e for outlet control for this arrangement was .35 and it did provide adequate performance in inlet control. The FEMA project was to test a short 10.5' diameter addition to the entrance of a 9.5' diameter pipe that was 165' long. This unique arrangement did provide improvement at the 100 year discharge, but no improvement for higher discharges when the barrel flows full.
 - d. Stream Power Experiments - Extended the work of Steve Smith and George Annandale.
 - e. Woodrow Wilson Bridge 3-D Numerical Model Study
 - f. Adaption of HYRISK for Risk Based Countermeasure Design - Sterling discussed the software which has been produced by GKY & Associates. He illustrated the 6 step process by showing and describing screens from HYRISK: Step 1- Describe the bridge, Step 2 -Economic assumptions (chance of death, value of life), Step 3 - Specify an annual failure probability or calculate with NBI data, Step 4 - Life expectancy for bridge, Step 5 - Review economic risks & reduce to present worth, and Step 6 - Specify Countermeasures and cost.
 5. Potential Future Projects

- a. Pilot study on Effects of Debris on Scour to help direct the proposed NCHRP study.
- b. Repeat some bottomless culvert experiments.
- c. Use flow visualization screening of scour countermeasure concepts.
- d. Partner with NCHRP for culvert hydraulic coefficients.
- e. Resolve HYDRA junction loss issues, as needed.

11. CONCERNS OF THE STATES

- OK Te Ngo said that Roy Jorgenson Associates, Inc is updating their hydraulic manual over the next 15 months.
- IL Dan Ghere said that they are revising drainage manual in house. The team meets every 45 days and they are about 50% done.
- NC Dave Henderson noted that they are reworking FEMA mapping. The work is being managed by his staff, but work is being done by two consultants. The first phase budget is \$33M for about 25% of state which will be done in 18 months. The whole state will cost \$65M and will be 50/50 split with FEMA. Retaining experienced employees continues to be a problem.
- IN Merrill Dougherty indicated that they have benefitted from recent transportation bill which has allowed them to fund all plans on the shelve. Many being done by design build. They are working overtime to complete more plans. Hydraulic staff is OK.
- HI Francis said that their new chief is from FHWA, that they are doing 20% of design in house, that since his staff is young that he was given permission to choose designs to be done in house.
- ON Saaed Choudhary said that the acquisition process for consultants started in January and that prices have not dropped, that they are only doing 5 to 10% of designs in house, that they are applying more value engineering, that floodplain policy is tight, and that environmental requirements are quite restrictive.
- OR Dave Bryson stated that they their hydraulic manual is 80% done, that primary author had to be taken off to work on maintenance projects for next year, that state forces could be charged with criminal offenses through endangered species act by killing fish, and that state would not defend and that they are now requiring detailed diversion plans when a culvert must be maintained.
- AK Mark Miles noted that they also have under staffing/recruitment/retention problems, that engineering positions have been moved up 2 ranges, that work load is heavy, that permitting has doubled and time to obtain has doubled, that environmental concerns are E&S control policy, bioengineering for bank a stabilization, that coastal zone policy is very strict, that his staff of two must do 25 scour retrofits and 24 monitoring plans in addition to normal work.
- ID Lotwick Reese noted that funding has doubled, that \$2.5M lawsuit was settled out of court for \$200k. He discussed bendway weirs that he used upstream of a bridge to move channel. He built weirs sequentially so that spacing could be determined in the field.
- WY Bill Bailey said that turnover rate is high in hydraulics and that fish passage is a concern.
- KS Jim Richardson related that the biggest concern is revenue shortfall for highway program. Because of shortfall, KDOT had to withdraw 14 projects that were being designed because construction funding was not available.
- SC Bill Hulbert said that they were doing 27 years worth of work in 7 years through bonding, that construction management of projects is being done by consultants, that he has been reviewing old scour studies and applying USGS findings on clear water scour, that he has found scour should be similar to contraction scour in vicinity of abutment, that research is needed for long bridges in the coastal plain, and that they are having problems getting contractors to comply with NPDES requirements.
- FL Shawn McLemore reported that fiber reinforced pipe plant is now up and running in Tampa, that they have a specification in place, that pipe has a bell and spigot type joint that is accomplished within the wall of the 1.5" thick pipe wall.
- PA Barry Newman reported that they are working on phase 2 general permit which will also apply to most

metropolitan areas, that licensing law permits land surveyors to do SWM plans, that they have had almost complete turnover of district staff in 5 years that he has been doing hydraulics.

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VISITORS**(Please Update Listing & Initial or Provide Information)**

Topeka, KS, April 30-May 4, 2001

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Shawn Schewnson	Bridge Section	

Scott Benortham

Bridge Section

AASHTO TASK FORCE ON HYDROLOGY AND HYDRAULICS
Spring 2001 MEETING
 Topeka, KS, April 30-May 4, 2001

AGENDA

Monday 4/30	<ul style="list-style-type: none"> ! Status of Task Force projects ! FHWA Activities & Updates ! Scour Update ! NTPEP for Software Validation 	<ul style="list-style-type: none"> Phil Thompson Phil Thompson Phil Thompson Dave Meggers, KDOT
	<p><u>2003 MDM Proposed Revisions</u></p> <ul style="list-style-type: none"> ! Ch. 18, Coastal Zone ! Ch. 13, Storm Drains ! Ch. 15, Surface Water Environment ! Ch. 16, Erosion & Sediment (Tuesday) ! Ch. 17, Bank Protection (Tuesday) ! Ch. 19, Construction (Tuesday) 	<p><u>Chapter Chairs</u></p> <ul style="list-style-type: none"> Dr. Billy Edge Bailey Ngo Henderson Hulbert Miles
Tuesday 5/1	<ul style="list-style-type: none"> ! NCHRP Research Proposals ! NCHRP Projects for 2003 ! NCHRP 15-23, MDM & HDG Support ! FHWA Hydrology and HYDRAIN Revisions 	<ul style="list-style-type: none"> Tim Hess Hulbert Ken Shearin/Don Potter Joe Krolak
	<p><u>2003 HDG Proposed Revisions</u></p> <ul style="list-style-type: none"> ! Vol. II, Hydrology ! Vol. III, Erosion & Sediment ! Vol. XIII, Training ! see MDM 16, 17 & 19 above 	<p><u>Volume Chairs</u></p> <ul style="list-style-type: none"> Hulbert for Boynton Henderson Miles
Wednesday 5/2	<ul style="list-style-type: none"> ! Field trip ! Business Meeting ! Concerns of the States 	<ul style="list-style-type: none"> All All All
Thursday 5/3	<p>Technical Presentations</p> <ul style="list-style-type: none"> ! HEC 18/20/23 ! NCHRP 24-16, 24-07(2), 21-07 ! Lag Times of Rural & Urban Watersheds ! Using NEXRAD Precipitation Estimates ! Sheet Pile Drop Structure Energy Dissipator ! SMS & WMS Updates ! Review of FHWA Research Topics 	<ul style="list-style-type: none"> Dr. Pete Lagasse Dr. Pete Lagasse Dr. Bruce McEnroe Dr. Bryan Young Brad Rognlie Dr. Larry Arneson Sterling Jones

GOALS AND TARGET DATES FOR COMPLETION (May 2001)AASHTO (202) 624-5800, www.transportation.org**AASHTO HIGHWAY DRAINAGE GUIDELINES****1999 Metric Edition 3 - Volumes 1-13 & Glossary, 740 pg, Cost \$125 (\$100 to members)****2000 Volume 14 is \$39 (\$32 to members)****4th Edition in dual units in progress for 2003**

<u>VOL</u>	<u>GUIDES</u>	<u>Chair</u>	<u>VOL</u>	<u>GUIDES</u>	<u>Chair</u>
1	Planning	Landry	9	Storm Drainage	Bailey
2	Hydrology	Boynton	10	Environmental	Ngo [<i>Miles 5/01</i>]
3	Erosion Control	Henderson	11	Coastal Zone	McLemore
4	Culverts	Thompson	12	Stormwater Man.	Dougherty
5	Legal Aspects	Richardson	13	Training	Miles
6	Channels	Bryson	14	Culvert Materials	DeCou
7	Bridges	Mills		Glossary	Bailey
8	Restoration	Boynton			

STEP

<u>VOL</u>	<u>NEW GUIDES</u>	<u>Chair</u>	<u>COMPLETE</u>	<u>ACTION NEEDED</u>
7E	Wetlands Hydrology	Hulbert	11	Distributed March 6, 2000
14	Culvert Materials	DeCou	11	Distributed March 6, 2000
15	Consultants	Veeramachaneni	3	SOD review
	Chronicles	Ghere	4	Review of update

STEPS FOR GUIDELINE PREPARATION

1. Author prepares draft.
2. Draft is reviewed by task force.
3. Author revises draft and defends at a task force meeting.
4. Author finalizes draft and sends copy of text and file to the secretary.
5. Secretary transmits to AASHTO for Subcommittee on Design (SOD) review.
6. Secretary transmits comments to author.
7. Author prepares final draft and sends file to the secretary who forwards to AASHTO.
8. AASHTO ballots SOD and informs secretary & task force chair of ballot results.
9. Author resolves comments and sends file to the secretary who forwards to AASHTO.
10. AASHTO ballots SCOH and informs secretary & task force chair of ballot results and whether the Board of Directors has elected to ballot.
11. AASHTO prints and distributes guide.

MODEL DRAINAGE MANUAL ASSIGNMENTS**1991 First Edition, 1368 pages, Cost \$260 (\$208 to members)****1999 Metric Edition [2nd] - WP6.1, 1248 pg, Cost \$360 (\$300 to members)****2000 Appendix 7E & 15G \$40 (\$34 to members)****[3rd Edition, separate SI & English manuals in progress for 2003]**

<u>Chapter</u>	<u>Leader</u>	<u>Team</u>	<u>Chapter</u>	<u>Leader</u>	<u>Team</u>
1 INTRO	Thompson		8 CHANNELS	Bryson	Choudhary
2 LEGAL	Richardson		9 CULVERTS	Thompson	Ngo, Bryson
3 POLICY	Nishioka	Ngo, Richardson	10 BRIDGE	Mills	Nishioka, Landry
4 DOC.	DeCou	Ghere, Bailey	11 ENERGY	Thompson	Newman, Ngo
5 PLANNING	Landry	Richardson, Tran			
6 DATA COL.	Reese	Nishioka, Veeramachaneni			
7 HYDRO.	Boynton	McLemore, Hulbert			

12 STORAGE (SWM)	Dougherty Veeramachaneni	Ghere,
13 STORM DRAIN	Bailey	Bryson, Reese
14 PUMP STATION	Ghere	DeCou, Reese
15 ENVIRONMENT	[Miles 5/01]	McLemore, Hulbert
16 EROS. & SED.	Henderson	Dougherty, [vacant]
17 BANK PROTECT	Hulbert	McLemore,
	[vacant]	
18 COASTAL ZONE	McLemore	Hulbert, [vacant]
19 CONSTRUCTION	[Ngo 5/01]	Richardson, Landry
20 MAINTENANCE	[vacant]	Bryson, Henderson
21 RESTORATION	(only in 1991 & 1999 editions)	
	Glossary	Bailey
		Thompson, Landry

Attachment E

AASHTO TASK FORCE ON HYDROLOGY AND HYDRAULICS (May 2000)

www.transportation.org/aashto/home.nsf/FrontPage

1. AASHTO Highway Drainage Guidelines (HDG) contain an overview, discussion and design philosophy for each of the covered topics:
 - A. HDG [Edition 1]
 - 1973, Volumes 1-3, Planning & Location, Hydrology, Erosion & Sediment Control
 - 1975, Volume 4, Hydraulic Design of Culverts
 - 1977, Volume 5, Legal Aspects of Highway Drainage
 - 1979, Volume 6, Hydraulic Analysis & Design of Open Channels
 - 1982, Volume 7, Hydraulic Analysis for the Location and Design of Bridges
 - 1987, Volumes 1-7 and 8, Hydraulic Aspects in Restoration & Upgrading of Highways
 - B. HDG [Edition 2]
 - 1992, Volumes 1-8 updated, Volume 9 (Storm Drain), Volume 10 (Environment) and Glossary
 - 1994, Volume 11, Coastal Zone
 - C. HDG, 1999 Metric Edition [3]
 - 1995, Volume 12, Stormwater Management approved, but printing was deferred.
Volume 13, Hydraulics Engineer Training and Career Development also deferred.
 - 1999, Volumes 1-13 and glossary were distributed on July 26, 1999.
 - 1999, Volume 14, Culvert Inspection, Material Selection and Rehabilitation was approved by SCOH. AASHTO distributed on 3/06/00.
 - D. HDG Edition 4 (Dual Units)
 - 1997, Review and update of volumes 1-13 was initiated.
 - 1998, Volume 15, Guideline for Hydraulic Design Consultants, *outline has been approved.*
 - 2001, NCHRP 15-23 www4.nationalacademies.org/trb/crp.nsf/rfps
2. AASHTO Model Drainage Manual (MDM) contains recommended design policy, criteria and procedures:
 - A. 1991 - MDM Edition 1 distributed 1/92 to states, Cost \$235 and \$190 to members. The 21 chapters include design procedures, example problems, and computer solutions for most aspects of highway hydraulic design.
 - B. 1994 - All chapters have been updated and graphics have been converted to digital format in preparation

for producing metric version of the manual (not distributed).

- C. 1999 - MDM Metric Edition [2] - The NCHRP contractor was TTI and Dr. Tom Debo. Three chapters (storage, pump stations and storm drains) were substantially revised. The WP6.1 format includes graphics in electronic format. MDM distributed on April 26, 1999.
2000 - Wetlands Hydrology appendices 7E & 15G distributed by AASHTO on 3/6/00.

- D. 1997 - MDM Edition 3 (Dual Units), Review and update of chapters 1-21 was initiated
2001, *NCHRP 15-23* www4.nationalacademies.org/trb/crp.nsf/rfps

TOTAL HIGHWAY BRIDGES AS OF 11/15/00 (4/26/01)

Attachment F

State	Bridges Over Waterways	Scour Screening										Scour Evaluations		
		Low Risk				Scour Susceptible	Unknown Foundations	Tidal	Scour Critical	Total Screened	%	Total Evaluated	Evaluation Candidates	%
		Culverts	Screened	Assessed	Total									
AK	810	34	0	372	406	0	201	53	150	810	100	556	0	100
AL	14022	5327	0	2178	7505	3526	2853	0	138	14022	100	7643	3526	68
AR	8540	3194	33	983	4210	24	3901	0	405	8540	100	4582	57	99
AZ	5561	3482	40	956	4478	71	172	0	840	5561	100	5278	111	98
CA	15725	2738	3420	5138	11296	515	3633	28	253	15725	100	8129	3935	67
CO	6793	1339	0	4987	6326	12	38	0	417	6793	100	6743	12	100
CT	2376	577	0	1148	1725	69	89	0	434	2317	98	2159	128	94
DC	94	0	0	93	93	0	0	0	1	94	100	94	0	100
DE	576	181	0	270	451	0	0	0	125	576	100	576	0	100
FL	8151	1740	679	2304	4723	120	2958	120	230	8151	100	4274	799	84
GA	12154	5318	0	729	6047	0	6031	0	76	12154	100	6123	0	100
HI	860	130	50	566	746	24	11	2	64	847	98	760	87	90
IA	23564	3116	763	14359	18238	96	4311	0	919	23564	100	18394	859	96
ID	3209	1073	0	1284	2357	0	587	0	265	3209	100	2622	0	100
IL	21641	3914	160	15633	19707	3	1272	0	614	21596	100	20161	208	99
IN	15903	1001	0	12703	13704	56	444	0	1699	15903	100	15403	56	100
KS	23851	6056	89	15730	21875	1433	93	0	454	23855	100	22240	1518	94
KY	11225	2641	0	8110	10751	11	424	0	39	11225	100	10790	11	100
LA	9891	0	0	3060	3060	810	5473	0	548	9891	100	3608	810	82
MA	2461	249	0	677	926	259	408	1	867	2461	100	1793	259	87
MD	3163	1017	0	992	2009	0	560	0	594	3163	100	2603	0	100
ME	1867	272	0	1039	1311	18	191	112	235	1867	100	1546	18	99
MI	7575	1111	0	2700	3811	2375	709	0	680	7575	100	4491	2375	65
MN	11331	4460	31	5474	9965	377	509	0	480	11331	100	10414	408	96
MO	20912	4026	0	16435	20461	308	18	0	101	20888	100	20562	332	98
MS	14790	2269	0	3137	5406	14	8608	0	762	14790	100	6168	14	100
MT	3664	142	989	672	1803	34	1826	0	0	3663	100	814	1024	44
NC	14024	4327	32	3123	7482	4	6371	82	85	14024	100	7535	36	100
ND	4153	757	100	922	1779	9	2291	0	74	4153	100	1753	109	94
NE	14889	2671	48	2407	5126	1246	8250	0	240	14862	100	5318	1321	80
NH	1755	163	80	1388	1631	30	50	0	44	1755	100	1595	110	94
NJ	3551	316	0	2407	2723	49	395	52	332	3551	100	3055	49	98
NM	3001	1563	172	671	2406	73	498	0	24	3001	100	2258	245	90
NV	884	553	27	111	691	37	51	0	105	884	100	769	64	92
NY	12105	1581	0	9458	11039	99	36	230	701	12105	100	11740	99	99
OH	23326	1338	0	16283	17621	5273	241	0	191	23326	100	17812	5273	77
OK	20835	5981	8	14345	20334	0	0	0	501	20835	100	20827	8	100
OR	5424	200	0	1627	1827	20	1974	69	1534	5424	100	3361	20	99
PA	17350	1635	1358	7044	10037	2101	988	0	4224	17350	100	12903	3459	79
PR	1597	241	63	745	1049	30	373	34	111	1597	100	1097	93	92
RI	337	30	0	176	206	0	0	0	131	337	100	337	0	100
SC	7784	1054	0	1170	2224	0	3704	155	1701	7784	100	3925	0	100
SD	5414	954	0	1636	2590	108	2695	0	0	5393	100	2590	129	95
TN	16506	7758	0	5948	13706	484	1260	0	1056	16506	100	14762	484	97
TX	40562	16647	0	12442	29089	757	9923	49	673	40491	100	29762	828	97
UT	1682	435	0	527	962	101	447	0	172	1682	100	1134	101	92
VA	9818	2747	0	7014	9761	2	0	0	55	9818	100	9816	2	100
VT	2304	68	0	1348	1416	373	246	0	298	2333	101	1714	344	83
WA	5144	135	0	3710	3845	72	305	0	922	5144	100	4767	72	99
WI	10689	1682	0	6722	8404	215	2002	0	68	10689	100	8472	215	98
WV	5742	350	4	3404	3758	25	1735	0	225	5743	100	3979	28	99
WY	1945	392	16	1059	1467	36	456	0	2	1961	101	1453	36	98
Nationwide	481530	108985	8162	227416	344563	21299	89611	987	24859	481319		361260	29672	
Percent		22.6%	1.7%	47.2%	71.6%	4.4%	18.6%	0.2%	5.2%	100.0%		92.4%	7.6%	

TECHNOLOGY APPLICATIONS (May 2001)

www.fhwa.dot.gov/bridge/hyd.htm

Chien-Tan Chang, HIBT, (202) 366-6749 is the COTR (Contract Office Technical Representative) for all projects. The COTR and the hydraulic engineers shown in parentheses provide technical oversight. The lead hydraulic engineer for each project is shown in **BOLD**.

1. DP 98, Underwater Inspection (**Thompson**, Pagán) Contractor is Collins Engineers, Tom Collins.
 - ! DP97 equipment grants provided to AL and AK.
 - ! Task awarded for dual unit conversion of HDS 4, HDS5 and HEC 22.
 - ! Drafts of HDS 4 and HDS 5 have been reviewed 5/01, HEC 22 review is pending.
2. FHWA Hydraulics Library (CD ROM) (**Thompson**) - Dr. Bill Grenney & Pallas Inc.
 - ! The CD with HDS 5, video, and MDM Chapter 9 was distributed in February 1997.
 - ! Library includes 32 publications (7 HDS, 19 HEC, HIRE, & 5 TS/IP), 3 videos. CDs distributed on 6/8/00. Windows HY8Energy & HY8InpGen available at bridge web site.
 - ! Dr. Grenney was awarded a task to enhance HY8InpGen to cover all shapes.
3. SMS & WMS (**Arneson**) - Version 6 of WMS and Version 7 of SMS are available at "www.ems-i.com". FHWA purchased new 3 year unlimited licenses for State DOTs on 10/1/99.
 - ! SMS contains FESWMS (FLO2DH), RMA2, and WSPRO interfaces.
 - ! WMS contains HEC1, TR20, NFF and rational interfaces.
 - ! Contract was awarded to add SMS interface for BRI-STARS.
 - ! FLOID interface is proposed for 2001
4. HY 22, Urban Drainage Design (**Thompson**) - HEC 22, SWM and Manning's Equation software has been distributed. Revised version is available at www.fhwa.dot.gov/bridge/hydsft.htm.
 - ! Zen Jao (CALTRANS) has completed Visual Urban version which is also available.
5. HEC 24, Design of Highway Pump Stations (**Thompson**) - FY97, Contract to develop a manual, software and 1-day module for NHI 13027 was awarded to PB (Peter Smith).
 - ! On 7/99 final \$100k obligated to contract and completion date extended to 1/21/2000.
 - ! HEC 24 available on web site. Training materials received. Alpha software is being tested.
6. DOT Information Service Digital Document Center (isddc.dot.gov) (**Thompson**) - DOT publications can be obtained over the web or through the mail (one free copy).
 - ! HY and CDS users manuals are available in scanned pdf format.
 - ! 32 publications on CD in HTML are available in pdf format at www.fhwa.dot.gov/bridge/hydpub.htm
 - ! RD, TS, and IP reports are being provided for scanning.
7. HEC Conversion to Dual Units (**Pagán**, Jones, Arneson, Krolak)
 - ! Funds provided for NHI task order for finalizing HEC 18 (4th Ed.), HEC 20 (3rd Ed.) and HEC 23 (2nd Ed.). HEC 20 and 23 are printed. HEC 18 will be printed in early May.
 - ! Lesson plans complete for updating NHI 135046 Scour Course and developing a 2nd 3 day course, NHI 135048 Countermeasure Design (HEC 23 and DP 97)
8. CAESAR Manual (**Pagán**, Arneson) - Develop manual and customize CAESAR for use by State DOTs.
 - ! Contract was awarded on 9/00 to Dr. Richard Palmer, University of Washington.
9. HEC 9, Design of Debris Control Structures (**Beucler**, Thompson) - West Consultants, PI Dennis Richards.
10. FY 2002 develop Manual for Sediment Transport Modeling.

NATIONAL HIGHWAY INSTITUTE (May 2001)
www.nhi.fhwa.dot.gov

Larry Jones, (703) 235-0523, is the NHI Course Coordinator and **Lynn Cadarr** (703) 235-0528 provides NHI Course Scheduling. Technical oversight of each course is provided by Larry Jones and the hydraulic engineers shown in parentheses. The lead FHWA and contractor hydraulic engineer for each course is shown in **BOLD**. Course descriptions can be found at www.nhi.fhwa.dot.gov/coursecb.html.

1. NHI 135010, Highways in the River Environment, 5 days (**Thompson**)
 - ! Ayres instructors are **Dr. P. Lagasse**, Dr. E.V. Richardson, Dr. D.B. Simons and Dr. Lyle Zevenbergen.
 - ! Ayres completed study of alternatives for providing dual units (available at www.fhwa.dot.gov/bridge).
 - ! Ayres awarded task on 10/6/99 to produce dual unit manual and 3 day course pilot by 2/02.
 - ! Draft dual unit HIRE manual has been reviewed. Final draft manual is expected by Fall.
2. NHI 135027, Urban Drainage Design, 3 days (**Thompson**), Cynthia Nurmi FHWA instructor
 - ! Ayres instructors are **Dr. Jim Schall**, Johnny Morris, Arlo Waddoups & Chris Carlson. Pilot dual unit course presented in KS on 7/99. Course is now available in either SI or English units. HEC 22 available at isddc.dot.gov.
 - ! NHI 135028, *Pump Station Design*, is in 2000 catalog. HEC 24 is available at www.fhwa.dot.gov/bridge/hydpub.htm
3. NHI 135035, Bridge Backwater Program, (WSPRO), 4 days (**Dr. Larry Arneson**, Krolak FHWA instructors)
 - ! WSPRO and PDF User's Manual are available at www.fhwa.dot.gov/bridge/hydsft.htm
4. NHI 135041, HEC-RAS, 4.5 days (**Arneson**) - available through 8/31/2000 (PSU) or 7/31/2000 (West)
 - ! PSU instructor is **Dr. Art Miller**. West instructors are **Dr. Jeff Bradley** and Dr. David Williams.
5. NHI 135046, Stream Stability and Scour at Highway Bridges, 3 days (**Pagán**, Arneson, Jones, Krolak, Nurmi FHWA instructors); Ayres Associates (thru 5/31/2002) instructors are **Lagasse**, Richardson, Morris, Waddoups and Zevenbergen.
 - ! NHI 13047, 1-day for bridge inspectors, is taught by Ayres.
 - ! HEC 20 (3rd Ed) and HEC 23 (2nd Ed) are printed. HEC 18 (4th Ed) will be printed in May.
 - ! Lesson plans developed for 3 day courses: 135046 (HEC 18 & 20) & 135048 Countermeasures (HEC 23 and DP 97).
6. NHI 135056, Culvert Design, 3 days (**Thompson**, Toillion FHWA instructors)
 - Ayres Associates (thru 5/31/2002) instructors are **Schall**, Morris, Waddoups, John Hunt, and Dave Frick.
 - ! HDS 5 is reference manual. The "Reprint 1998" edition is available at isddc.dot.gov.
 - ! Metric HEC 14 in pdf format available at www.fhwa.dot.gov/bridge/hydpub.htm
 - ! Course needs to be converted to dual units. Draft dual unit HDS 5 has been completed.
7. NHI 135057, HYDRAIN, Integrated Drainage Design Software, 3 days, (**Krolak** FHWA instructor)
 - GKY and Associates instructors are **Stu Stein**, Bret Martin, *Dr. Ken Young*, *Dave Pearson*, *Christine Estes*
 - Course manuals have been updated to Version 6.1.
 - ! Contract has being extended to 5/2002 and error correction task was added to produce version 6.2.
8. NHI 135065, Introduction to Highway Hydraulics, 3.5 days, (**Pagán**, Toillion, *Beucler* FHWA instructors)
 - Ayres Associates instructors are **Schall**, Morris, Waddoups, Dave Frick, and Doug Leihou.
 - ! HDS 4 was distributed in July 1997 and the course is available. HDS 4 is being converted to dual units.
 - ! Future task to produce 1-day overview course with flume for construction & maintenance personnel.
9. NHI 135067, Practical Highway Hydrology, 3 days, (**Krolak** FHWA instructor)
 - Greenhorne & O'Mara, Inc. instructors are **Ali Abbasi**, Paul Kock, and Roger Kilgore.
 - ! Course is based on metric HDS 2, Highway Hydrology manual. Course is available.
 - ! FY 2000 task has been awarded to update and convert to dual units both HDS 2 and the course.
10. NHI 135071, FESWMS/SMS, 4.5 days, (**Arneson** FHWA instructor) - Parsons Brinckerhoff, Conor Shea, PI.
 - ! Course available thru 9/2001. User's manual is being worked on by Dr. Dave Froehlich.
 - ! New 1-D course proposed for FY 2001 in partnership with tidal scour pool funded project.
11. NHI 135080, Hydrologic Modeling with the Watershed Modeling System (WMS), 3 days (**Arneson** FHWA instructor)
 - ! Task awarded to Greenhorne & O'Mara, Inc. (**Paul Kock**) and EMRL (**Dr. Jim Nelson**).
 - ! 1st pilot in CA in 8/2000 and 2nd pilot in PA in 11/2000. Course is available.

FHWA Hydraulic Engineering Publications
www.fhwa.dot.gov/bridge/hydpub.htm
May 2001

The PUBLICATIONS are available from NTIS, National Technical Information Service, 5285 Port Royal Rd, Springfield, VA 22161, (703) 605-6000 (www.fedworld.gov/ntis). Electronic versions for some publications are available at DOT digital document center: isddc.dot.gov.

HYDRAULIC DESIGN SERIES (HDS)		YEAR	FHWA-#	NTIS-#
HDS-1	Hydraulics of Bridge Waterways	1978	EPD-86-10	PB86-181708
HDS-2	Highway Hydrology (SI)	1996	SA-96-067	PB97-134290
HDS-3	Design Charts for Open-Channel Flow	1961	EPD-86-10	PB86-179249
HDS-4	Introduction to Highway Hydraulics (SI)	1997	HI-97-028	PB97-186761
HDS-5	Hydraulic Design of Highway Culverts*	1985	IP-85-15	PB86-196961
HYDRAULIC ENGINEERING CIRCULARS (HEC)		YEAR	FHWA-#	NTIS-#
HEC-9	Debris-Control Structures	1971	EPD-86-10	PB86-179801
HEC-11	Design of Riprap Revetment	1989	IP-89-016	PB89-218424
HEC-14	Hyd. Design of Energy Dissipators for Culverts & Channels *	1983	EPD-86-11	PB86-180205
HEC-15	Design of Roadside Channels with Flexible Linings *	1988	IP-87-7	PB89-122584
HEC-17	Design of Encroachments on Flood Plains using Risk Analysis	1981	EPD-86-11	PB86-182110
HEC-18	Evaluating Scour at Bridges, Edition 3 (SI)	1995	HI-96-031	PB96-163498
HEC-20	Stream Stability at Highway Structures, Edition 2 (SI)	1995	HI-96-032	PB96-163480
HEC-21	Bridge Deck Drainage Systems	1993	SA-92-010	PB94-109584
HEC-22	Urban Drainage Design Manual (SI)	1996	SA-96-078	PB97-134308
HEC-23	Bridge Scour and Stream Instability Countermeasures (SI)	1997	HI-97-030	PB97-199491
HEC-24	Highway Stormwater Pump Station Design	2001	NHI-01-007	
IMPLEMENTATION REPORTS (IMP)		YEAR	FHWA-#	NTIS-#
HIRE	Highways in the River Environment	1990	HI-90-016	PB90-252479
IMP	Underground Disposal of Storm Water Runoff, Design Guidelines	1980	TS-80-218	PB83-180257
IMP	Guide for Selecting Manning's Roughness Coef. for Natural Channels and Flood Plains	1984	TS-84-204	PB84-242585
IMP	Culvert Inspection Manual	1986	IP-86-2	PB87-151809
IMP	Structural Design Manual *	1983	IP-83-6	PB84-153485
PUBLICATIONS ON CD-ROM **		YEAR	FHWA-#	NTIS-#
HDS-5	Hydraulic Design of Highway Culverts (CDROM), v1.00	1996	SA-96-080	N/A
	Installation and User's Guide (SI computation aids)	1996	SA-96-081	N/A
	FHWA Hydraulics Library	2000	IF-00-022	

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The software and related publications listed below are available at www.fhwa.dot.gov/bridge/hydsoft.htm or:

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PC-TRANS - 2011 Learned Hall, Lawrence, KS 66045, (913) 864-5655, FAX (913) 864-3199 (kuhub.cc.ukans.edu/~pctrans/index.html)

	TITLE	YEAR	MCTRANS	FHWA-#	NTIS-#
HY-7	Bridge Waterways Analysis Model	1999	WSPRO		
	WSPRO Research Report	1986	WSPRO.D	RD-86-108	PB87-216107
	WSPRO User's Manual (Version P60188)	1999	WSPRO.D	SA-98-080	
HY-8	FHWA Culvert Analysis (Version 6.1)	1999	HY8		
	Hydraulic Design of Highway Culverts	1985	HY8.D	IP-85-15	PB86-196961
	Research Report (Version 1.0)	1987	HY8.D		
	HY 8 Applications Guide	1987	HY8.D	ED-87-101	NA
HY8InpGen	HY 8 Input Generator (95/98/NT)	2000			
HY8Energy	HY 8 Energy (95/98/NT)	2000			
HY-9	Scour at Bridges (Version 5.0) - Now in WSPRO	1994			
HY-10	BOXCAR (Version 1.0) [<i>Version 2 ACPA</i>]	1989	BOXCAR		
	BOXCAR Users Manual	1989	BOXCAR.D	IP-89-018	PB90-115486
	Structural Design Manual	1983	BOXCAR.DS	IP-83-6	PB84-153485
	PIPECAR (Version 2.1)	1993	PIPECAR		
	PIPECAR Users Manual (Version 1.0)	1989	PIPECAR.D	IP-89-019	PB90-115478
	Structural Design Manual	1983	PIPECAR.DS	IP-83-6	PB84-153485
	CMPCHECK (Version 1.0)	1989	CMPCHECK		
HY-11	Preliminary Analysis System for WSP	1989	PAS		
	PAS USERS MANUAL	1989	PAS.D	IP-89-013	PB90-112723
HY-12	<i>Flo2DH (Version 3.01) [available with course]</i>	2000			
	<i>Flo2DH, Users Manual</i>	2001		RD-01-??	NA
	FESWMS-2DH, Research Report	1989	FESWMS.DS	RD-88-146	PB91-106492
HY-22	Urban Drainage Design (see HEC-22)	1999			
	VisualUrban (95/98/NT)	2000			
CANDE	CANDE-89 (Version 1.0)	1989	CANDE		
	CANDE, Users Manual	1989	CANDE.D	RD-89-169	NA
HYDRAIN	Drainage Design System (Version 6.1)	1999	HYD6		
	HYDRAIN Users Manual (pdf)	1999	NA	IF-99-008	NA
BRI-STARS	Bridge Stream Tube for Alluvial River Sim.	2000			
	BRI-STARS Users Manual (Version 5.03)	2000		RD99-190&1	