

October 11, 2001

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400 7th Street, SW., Room 3203  
Washington, D.C. 20590

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

FROM: Secretary

SUBJECT: Minutes of the Fall Meeting, Timonium, Md

Attached are minutes of the meeting of the Task Force on Hydrology and Hydraulics held at the Days Hotel in Timonium, Md on October 1-5, 2001. Corrections will be accepted prior to the next meeting. At the meeting, the task force members extended their appreciation to Raja Veeramachaneni for his handling of meeting arrangements and for setting up the field trip. The Task Force would like to express their sincere condolences and sympathy to Raja on the loss of his mother.

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

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

| <b><u>TASK FORCE MEMBER</u></b> | <b><u>STATE</u></b> | <b><u>JOINED</u></b> | <b><u>REGION</u></b> |
|---------------------------------|---------------------|----------------------|----------------------|
| B. Bailey                       | Wyoming             | 1994                 | 4                    |
| J. Boynton                      | Minnesota           | 1998                 | 3                    |
| D. Bryson                       | Oregon              | 1994                 | 4                    |
| S. Choudhary                    | Ontario             | 1998                 | 3                    |
| B. Dawe                         | Illinois            | 2001                 | 3 (new)              |
| G. DeCou                        | California          | 1994                 | 4 (absent)           |
| M. Dougherty, Chair             | Indiana             | 1994                 | 3                    |
| M. Fazio                        | Utah                | 2001                 | 4 (new)              |
| D. Ghere                        | Illinois            | 1975                 | 3 (resigned)         |
| P. Helms                        | South Carolina      | 2001                 | 2 (new, absent)      |
| D. Henderson                    | North Carolina      | 2000                 | 2                    |
| W. Hulbert                      | South Carolina      | 1992                 | 2 (resigned)         |
| D. Landry                       | Vermont             | 1997                 | 1 (absent)           |
| S. McLemore                     | Florida             | 1992                 | 2 (resigned)         |
| M. Miles                        | Alaska              | 2000                 | 4                    |
| R. Mills                        | Virginia            | 1999                 | 2 (alternate)        |
| B. Newman                       | Pennsylvania        | 1997                 | 1                    |
| F. Nishioka                     | Hawaii              | 1991                 | 4 (absent)           |
| T. Ngo                          | Oklahoma            | 1991                 | 4                    |
| L. Reese                        | Idaho               | 1996                 | 4                    |
| R. Renna                        | Florida             | 2001                 | 2 (new, absent)      |
| J. Richardson, Vice Chair       | Kansas              | 1996                 | 3                    |
| D. Stolpa                       | Texas               | 2001                 | 4 (new)              |
| P. Thompson, Secretary          | Washington, DC      | 1989                 | 1                    |
| Duc minh Tran                   | Quebec              | 1999                 | 1 (absent)           |
| R. Veeramachaneni               | Maryland            | 1997                 | 1                    |

#### **VISITORS PRESENT** (see attachment B)

#### 1. **MEETING SUMMARY**

##### **MEETING AGENDA** (See attachment C)

##### **PAST MEETINGS** (Minutes available from Secretary)

| <b><u>YEAR</u></b> | <b><u>MEETING</u></b> | <b><u>ZONE</u></b> | <b><u>LOCATION</u></b> | <b><u>DATE</u></b> |
|--------------------|-----------------------|--------------------|------------------------|--------------------|
| 2002               | 62-Spring             | 4                  | ID                     | May                |
| 2002               | 63-Fall               | 4                  | OK                     | October            |
| 2003               | 64-Spring             | 3                  | IN                     | May                |
| 2003               | 65-Fall               | 2                  | WY                     | October            |

## 2. **WELCOME AND INTRODUCTIONS**

- A. Chair Merrill Dougherty welcomed the members of the task force and:
  - ! Thanked Raja Veeramachaneni for making the meeting arrangements.
  - ! Asked everyone to introduce themselves (see attachment B for visitors).
  - ! Noted that the meeting registration cost would be \$85.
- B. Raja welcomed the task force and introduced Neil J. Pederson, Deputy Administrator for Planning and Engineering who is responsible for Highway Development where Raja's Highway Hydraulics Division is located and for Bridge Development where the bridge hydraulics group is located.
  - 1. Neil Pederson provided the following observations:
    - a. Need has grown significantly for hydraulic involvement in highway development.
    - b. Computer tools have greatly enhanced highway design over his 30 year career.
    - c. MD SHA is blessed with Chesapeake Bay, but also comes with a complex set of regulations.
    - d. Raja is working with citizens groups in Annapolis to balance environmental concerns.
    - e. MD SHA is a leader in context sensitive design and he noted that H&H is known for considering environmental issues.
    - f. Personally thanked the Task Force for their work.
  - 2. Raja discussed the field trip on Wednesday to visit environmental sights and indicated that he had passes for the light rail system.

## 3. **BUSINESS MEETING ACTIVITIES (Monday & Friday)**

- A. Membership: David Stolpa of TX nomination is pending.
- B. Treasurer Report - After paying for 2 plaques & meeting costs, the balance is about \$760.
- 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. Draft of new HDG Volume 11
  - 2. Roy Jorgensen Corrections for 2003 HDG and MDM for NCHRP 15-23
  - 3. Roy Jorgensen Style and Format Report and Editing Recommendation Guide for NCHRP 15-23
- \* E. Future meeting locations were discussed and sites selected (see page 1). The spring 2002 meeting will be held in ID at Coeur d'Alene on May 6-10. The Fall 2002 meeting will be in Oklahoma. The Spring 2003 meeting will be in Indiana. The Fall 2003 meeting will be in WY at Jackson Hole or Cody.
- F. The following agenda items are proposed for the next meeting:
  - 1. Resolution of SOD comments of rewrites for 2003 HDG3 and MDM3.
  - \* 2. Review of SOD ballot comments for HDG 15, Guideline for Hydraulic Design Consultants. Raja provided corrected HDG 15 to Ken Kobetsky at the meeting.
- G. Reviewed guideline and MDM target dates. See attachment D which contains assignments for MDM chapters and HDG volumes. Corrections were made had the meeting to assignments on attachment D.
- \* H. Task Force voted to request an additional \$50k of funds for NCHRP 15-23 so that another 150 graphics can be improved for the MDM. The chair will forward the request to NCHRP. An addition, it was agreed that the chapter chairs should complete the Roy Jorgensen proposed enhancements by

November 9th and that the task force should have review of the new material complete by November 26th so that comments can be provided to Roy Jorgensen by early December. Ken Shearin indicated that updated list of comments will be prepared soon.

- I. The following topics were previously suggested for future work of the task force: MS4 guidelines, workflow processing guideline, marketing, ground water hydraulics, hydroplaning.
- J. Ken Kobetsky provided an update of AASHTO activities. He indicated that new executive director has adopted 5 CORE groups: meetings, publications, business manager, government relations and engineering technical services. Tony Kane, previously of FHWA, is head of engineering and Ken's manager. He noted that Patty Kelly, publications, has left. He indicated that current emphasis is on facility operation and maintenance. This past week National Security Task Force was appointed. He recommended the following:

- \* 1. Jim McDonald should be contacted to see if he is available for next meeting.
- \* 2. Copy-right concerns for MDM need to be resolved.
- \* 3. Web site for coordination may be possible. Currently, working on setting up one for Green Book.
- \* 4. Work with SOD to get NCHRP problem statements prioritized.
- \* 5. Discuss NCHRP problem statements with your RAC members after they are posted on the web in mid December. Review takes place in January and ballots must be complete by mid February.

#### 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](http://isddc.dot.gov).)

A. The following is a summary of items discussed:

- 1. DP 98 project has been closed out.
- 2. WMS interface will be developed for HYDRA.
- 3. HEC25, Tidal Hydrology and Hydraulics has started.
- 4. 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 (Attachment F). Phil noted the following which is summary of 4/15/01 data:

- 1. Only 232 of 481,251 bridges over water have not been screened. Of bridges screened, 18.4% (88,686 bridges) have unknown foundations.
- 2. 93% (364,226) of 391,726 bridges needing evaluation have been evaluated for scour and 7% (27,500) still need evaluation.
- 3. 8 DOTs have completed 100% and 34 DOTs have completed more that 90% of needed evaluations.
- 4. 10 DOTs have not completed 90% of their needed evaluations.
- 5. 24 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 an 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 [trb.org](http://trb.org).

- 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 is complete and is being considered for printing. RFP for risk based guidelines will be advertised 11/01(\$100k).
  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 to 10/2004.
  3. 24-14 Scour at Contracted Bridge Sites - \$500k Art Parola/Dave Mueller -interim report, complete June 2003. USGS is matching with \$500k.
  4. 24-15 Bridge Scour in Cohesive Materials - \$350k TX A&M, have interim report, complete 2/2002. The panel has requested \$400k to study abutments.
  5. 24-16 Channel Migration - \$650k Ayres, Pete Lagasse, extended to 6/2003 to include photo interpolation handbook.
  6. 25-12 Wet Detention Pond Research - \$580k by David Young of WSU, final report is due.
  7. 21-07 Development of Portable Scour Monitoring Equipment - \$300k Ayres, Jim Schall, started 4/00 and is 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) awarded 6/2001, target completion 5/2002
  12. 24-20 Prediction of Scour at Bridge Abutments - \$500k, RFP 8/01, proposals due 10/01
  13. 20-07(146) Development of Software Verification Protocol for Hydrologic and Hydraulic Models - \$100k, requested panel members be sent to him at timhess@nas.edu. Saeed, Barry, Te Mark, and Bill volunteered. Phil recommended Glen DeCou, Joe Krolak, and Peter Smith.
- 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. Jim McDonald recommended F3 to SCOH and it was funded, see 20-07(146) above. 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 Projects 2003 - 10/01 Tim Hess indicated that he had received the above problem statements from the chair and had included them in group for consideration at March 2002 SCOR meeting.
- K. NCHRP 15-23 Technical support for MDM and HDG, \$200k (Tim Hess, project manager) - Task force panel is Merrill Dougherty (chair), Phil Thompson, Dave Bryson, Shawn McLemore, Roy Mills, and John Boynton.
1. At the 5/01 meeting, Roy Jorgensen 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.
  2. At the 10/01 meeting, Roy Jorgensen PI, Ken Shearin, and Don Potter provided handouts and discussed the following items:
    - a. Ken passed around a mock up of the SI MDM to demonstrate the format used. Handed out & discussed Style and Format Guide and the Editing Recommendations. Ken Kobetsky provided guides to AASHTO staff for review. AASHTO style recommendations were adopted.
    - b. Ken passed out inventory of graphics and indicated that Phil would review and provide updates.
    - c. Don will rerun computer models, review metric numbers using Green Book as a guide.
    - d. Ken reviewed schedule: SI drafts in Jan 2002, draft approved in April, conversion strategy will need to be approved by May 2002.
    - e. Don reviewed the task 1 & 2 requirements. He noted that 300 hours of review provided 635 suggestions. He indicated that there were differences between HYDRA 6.1 and previous calculations. (NOTE: 6.2 should be obtained from Joe Krolak)
    - \* f. Task Force chairs reviewed and approved the majority of comments. The remainder were discussed and either adopted, rejected or modified. Ken and Don took notes and will revise the recommendations report to indicate the changes and corrections. The chairs will draft material for the Appendix C enhancements and provide to the secretary by 11/ 9/01 so that they can be reviewed by task force by 11/26/01 and provided to Ken by 12/1/01.
    - g. Ken Kobetsky recommended SOD balloting of the draft 2003 SI MDM and HDG when complete 4/2001.
    - \* h. Task Force agreed to request \$50k from NCHRP to enhance graphics. The chair who is also chair of the NCHRP panel will formally send the request to Tim Hess.

## 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 has 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.
- h. Secretary updated approved list of comments dated 7/20/01& provided to NCHRP 15-23 contractor.
- i. Fall 2001, NCHRP 15-23 corrections reviewed and most adopted.

2. 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
- II. Hydrology (John Boynton) - review is complete, corrections read 5/01.
- III. Erosion & Sediment (Dave Henderson) - corrections complete 5/98, revisions complete 10/01
- IV. Culverts (Phil Thompson) - corrections complete 5/98, revisions complete 10/98
- V. Legal (Jim Richardson) - corrections complete 5/98, revisions complete 10/98
- 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
- IX. Storm Drains (Bill Bailey) - corrections complete 5/98, revisions read 5/01
- X. Environment (Mark Miles) - corrections complete, revisions read 5/00
  - File of volume with corrections provided to NCHRP 15-23 contractor.
- XI. Coastal Zone - Dr Billy Edge did a table reading of new volume and task force provided comments. Dr. Edge will make corrections and provide file to the secretary.
- XII. SWM - New, no changes
- XIII. Training (Mark Miles) - New, corrections complete 5/01
- XIV. Culvert Rehabilitation - New, no changes
- XV. Consultants - Final draft provided to AASHTO for SOD ballot.

\*

Glos 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.

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.
  - \* 5. At Fall 2001 meeting, final draft provided to AASHTO (Ken Kobetsky) for SOD ballot.

## 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.
  - h. Secretary updated approved list of comments dated 7/31/01& provided to NCHRP 15-23 contractor.
  - i. Fall 2001, NCHRP 15-23 corrections reviewed and most adopted.

### 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
6. Data Collection (Lotwick Reese) - corrections complete 5/98, revisions complete 10/00

7. Hydrology (John Boynton) - revisions complete 10/00, corrections complete 10/01
  8. Channels (Dave Bryson) - corrections complete 5/98, revisions complete 10/98
  9. Culverts (Phil Thompson) - corrections complete 5/98, revisions complete 10/98
  10. Bridges (Roy Mills) - corrections complete 5/98, revisions complete 10/98
  11. Energy (Phil Thompson) - corrections complete 5/98, revisions complete 10/00
  12. Storage (SWM) (Merril Dougherty) - corrections complete 5/98, revisions complete 5/01
  13. Storm Drains (Bill Bailey) - corrections complete 5/98, revisions read 5/01
  14. Pump Stations (Dan Ghere) - corrections complete 5/98, revisions complete 10/00
  15. Environment (Mark Miles) - review complete 10/00, revisions read 5/01
  16. Erosion & Sediment Control (Dave Henderson) - corrections complete 5/98, revisions read 5/01
  17. Bank Protection (Bill Hulbert) - corrections complete 5/98, revisions read 5/01
  18. Coastal Zone (Raja Veeramachaneni) - 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.
    - c. Secretary provided updated file to NCHRP 15-23 contractor after the 5/01 meeting.
  19. Construction (Te Ngo) - review complete 5/01, revisions read 5/01
  20. Maintenance (David Stolpa) - 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
- \* 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 was 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 vendor 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](http://www.landxml.org)) will include hydrology and hydraulics. Information is available on XML standard at [www.aecxml.org](http://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.

- \* C. NCHRP 20-07(146) Development of Software Verification Protocol for Hydrologic and Hydraulic Models was approved by SCOH for \$100k - Tim Hess requested panel members at the Fall 2001 meeting. Those interested should email him at [timhess@nas.edu](mailto:timhess@nas.edu). Saeed, Barry, Te, Mark, and Bill volunteered. Phil recommended Glen DeCou, Joe Krolak, and Peter Smith.

## 9. **FIELD TRIP**

On Wednesday, the task force received copies of "Environmental Responsibility" by MDSHA and an itinerary book with photographs of sites A & C below. The following sites were toured:

- A. I-83 Piney Creek near Hereford- a very well done stream restoration project adjacent to a retaining wall along I-83 and a picturesque fenced pasture.
- B. Fairland Park, off MD 198 Montgomery County - MD Dept of Environment demonstration area where a gravel pit was reclaimed. The following features were shown and explained: Infiltration trench, recharge pond, wet pond, sand filter adjacent to parking lot and porous pavement.
- C. Forty Foot Bridge (Naylor Road and MD 5 in Suitland - a box culvert with an outlet scour problem and large bed load was stabilized with a series of rock weirs. Deposition in multiple circular culverts downstream was decreased after the installation of the weirs.

## 10. **TECHNOLOGY PRESENTATIONS**

- A. MD Stormwater Management (SWM) Manual - Ken Pensyl discussed MD Dept. of Environment regulations and guidelines using a Power point presentation. Regulations were started statewide in 1982 to protect the Chesapeake Bay. Originally they used 0.5" first flush criteria, now they use 1" and require a recharge value based on the soil type. A channel protection volume is required based on 1 yr 24 hr extended detention. A new feature is that redevelopment must also do SWM. They provide incentives for nonstructural measures (disconnected runoff, sheet flow buffer, grass channels). Acceptable BMPs must not only be designed and sized properly, but also must be constructed correctly and maintained. BMPs are ponds, wet ponds, pocket wetlands, infiltration trenches, perimeter sand filters, organic filter, bioretention areas and open channel practices. NPDES phase 1 was implemented in 10 counties and most of the state will be included in phase 2. He provided copies of a one page summary of the program. Their manual is available at [www.mde.state.md.us](http://www.mde.state.md.us).
- B. Low Impact Development (LID) Approach for Stormwater & Urban Retrofits - Neil Weinstein, LID Center, Inc., provided a handout of his Power point presentation. He discussed the mission of their non-profit organization: to pilot projects, monitoring, modeling, manuals, training and education. LID is an innovative, ecosystem-based approach to land development and stormwater management for urban highway and drainage applications. They are involved in the SWMM model and are updating.
- C. NPDES Source Identification - Sonal Sanghavi, MD SHA NPDES Program Manager, indicated that NPDES was initiated by 1987 amendments to Clean Water Act. The Municipal Separate Storm Sewer (MS4) requirements issued in January 1999 apply to SHA's outfalls. She described MDSHA program to identify outfalls and record information in a GIS. She estimates that it will take 1.5 years to complete data collection which will include photographs. The data will be used for MS4 inspections, illicit discharge identification, spill management, and infrastructure management. She has started an inspection and remediation program of SWM facilities. They will have a \$1.5M budget for maintenance next year.
- D. Stormwater Management (SWM) Facility Inspection and Remediation - Sonal Sanghavi, MD SHA, and William Park, Jr, GPI, discussed inspection elements, protocol, inspection methodology, types of SWM facilities. The key inspection elements are site features, water quality performance, embankment and structures. The features of the SWM facility are scored from 1 to 5 using a guideline. The inspection methodology includes prefield documentation, field investigation, postfield investigation. Bill discussed types of facilities inspected and what is evaluated. Problems encountered are debris, excessive ponding, erosion at outfalls, excessive vegetation on fills, poor maintenance access, temporary ponds converted to permanent ponds, and structural failure. The consultants provide facility ratings which are used to indicate a priority rating system for BMPs from A-F (F is a public hazard). Remediation will be replacement of failed facilities, function retrofit, or performance retrofits.
- E. Stream Restoration in-lieu of Stormwater Management - Karuna Pujara, MD SHA, indicated the need to stabilize natural streams for the 2 & 10-yr flows. She provided an overview of MD SHA

SWM guidelines and manual. She described the Water Quality and Channel Protection Volumes. Stabilization can be accomplished by increased resistance and/or decreased tractive force. BMPs that are used are flow deflectors, vegetative controls, retaining structures that are effective above bank full stage, and stable outfalls. A key element in the process is identifying a reference reach for comparison to constructed reach. Methods for quantifying SWM quality credits for stream restoration are field measurements of the rate of erosion and comparison to as built. Would like to establish annual sediment yield. Stream Power in the reference reach is used as a target. Are using bank pins for field measurement and hope to develop a regional curve. Costs for treatment are \$20 to 25k per acre or \$100 per linear foot of stream restored. As an indicator of success, the MD DNR Physical Habitat Index numbers are control reaches (83), restored reaches (77) and state average (71). In addition, fish monitoring has shown a substantial increase in number of fish.

- F. Incorporating a Fluvial Geomorphology Approach in Culvert Design - Stan Davis and Andy Kosicki, MD SHA, provided a handout of their PowerPoint presentation. Andy indicated that their design process began to change in 1993 to respond to concerns of environmental agencies, and they now emphasize stream geomorphology in the design of culverts and bridges. Rosgen's stream classification system is used to determine bankfull flow, since it is this flow that best serves to evaluate sediment discharge. Stan showed typical stream stability problem areas. He discussed the eight-step design process, design concepts and geomorphology study process. He showed examples of cross vane and J hook rock structures that are used for vertical controls and bank stabilization. He discussed their approach of matching structure design to the natural stable channel characteristics. The process was illustrated with a case history of MD 136 over James Run. Efforts are underway to improve the design process through updating manuals and a joint study with the U. S. Fish and Wildlife Service to create statewide regional curves of stream characteristics for bankfull flow. Challenges include "hands-on" training in evaluating and classifying streams; improved partnering arrangements and coordination with resource agencies; and monitoring of completed projects.
- G. Water Budget & Groundwater Studies to Protect Bog Turtles - Stephen Buckley MD SHA & Kelly Brennan of PB discussed the surface and groundwater studies they performed as a part of an environmental reassessment of a highway bypass that would also include access to a proposed 1.2 km<sup>2</sup> industrial park. The development would occupy about 75% of the area of the watershed. The reassessment was needed when the bog turtle was added to the threatened list in 1997. The bog turtle is a 4" turtle that spends most of its life below ground in the mud. The turtles have suffered a 43% decline over 15 years according to Frostburg State who conducted a biological assessment and made recommendations. Kelly described hydrologic study conducted by PB. They identified surface water drainage network of the watershed that is 90% forested and has 112 cm average annual precipitation. They performed extensive field monitoring for 1 year with 12 observation wells, 2 precipitation gages, 28 piezometers and 5 stream gages. The surface water was modeled with TR 55 & 20 which indicated a 21% increase in runoff for the bypass and a 362% increase for industrial park. Ground water was modeled with visual MODFLOW using a 2 layer system. Because the 240' of relief, a 50' grid of cells was used, but was increased to 264' x 184'. The model indicated no decrease in ground water for bypass, but an average of 10' of drawdown for east only development and 14' for full development. MD 2000 guidelines were used to try to accommodate recharge recommendations. The final project will include a bog turtle preserve, no flyover and 50% of the proposed industrial park.
- H. Hydrologic Analysis Criteria Developed by State Hydrology Panel in MD - Will Thomas, Michael Baker Engineering, discussed with overheads the hydrologic procedures developed by the Hydrology Panel for the State of Maryland. In Maryland, the Water Management Agency (WMA) of the Department of the Environment has review and permitting responsibilities of hydrologic analyses performed by the Maryland State Highway Administration (MSHA) for culvert and bridge design. WMA selected the NRCS TR-20 model as the hydrologic procedure of choice because of its ability to estimate flood discharges for ultimate development. The WMA was reluctant to accept USGS regression equations, the procedure of choice by MSHA, because of its inability to estimate ultimate

development discharges. MSHA believed that the TR-20 model tended to overestimate flood discharges based on their agency experiences, a 1981 report prepared by the U.S. Water Resources Council, and a 1992 report prepared by the University of Maryland. A hydrology panel was convened jointly by MSHA and WMA to resolve issues related to hydrologic analyses for streams in Maryland. The Panel recommended in a February 1, 2001 report that the TR-20 model be “calibrated” for existing land use conditions to frequency curves based on gaging station data, frequency curves transposed from gaging stations, and/or frequency curves based on USGS regression equations. The objective is to adjust TR-20 model parameters, such as runoff curve number and time of concentration, to get the TR-20 flood estimates to fall between the statistically-based frequency curve and the upper 67 percent prediction limit. The model parameters from this “calibrated” existing conditions model are then adjusted to provide ultimate land use discharges. The Panel report provides guidance on the variables to be adjusted and a reasonable range of adjustment. A peak rate factor of 284 is used for the coastal plain region in lieu of the standard NRCS 484 factor. In addition, 6- or 12-hour design storm duration is used if appropriate. The Panel recommended future research on time of concentration, unit hydrograph peak rate factors, peak discharge transposition, design storms, statistical alternatives, and models for use on mixed urban-rural watersheds. Lastly, the report is considered a dynamic report and updates will be made as new research is completed.

- I. GISHydro2000 -A Customized GIS-Based Tool for Hydrologic Analyses in Maryland - Dr. Glenn Moglen, Univ. of MD, illustrated the capabilities of GISHydro2000 for hydrologic analyses in MD. He indicated that the free software is available at <http://www.gishydro.umd.edu>. The software eliminates about 75% of the effort needed to make an estimate. However, the GIS support software (ArcView 3.2 and Spatial Analyst 1.1) is not free and costs about \$3000. A main advantage of the GIS based tool is that the data is integrated with the GISHydro2000 software. Data includes topography, land use, and soils information which is all available on a 100 foot (approximately 30m) grid. The operation sequence was demonstrated: select quads, DEMs, land use, and soils data, choose the outlet (software delineates watershed automatically). The software determines the basin composition and statistics and locates any nearby stream gages. It calculates the discharges for the 2 through 500 year events. Next the TR-20 interface in GISHydro2000 was demonstrated. The user indicates the level of subdivision desired. A time of concentration tool allows the user to indicate what method is wanted: SCS Lag, Hydrology Panel equation, or Velocity Method. The “X” tool is used to indicate cross-sections to be used for routing reaches. Finally, a “Control Panel” is used for inputting all non-GIS data. A TR-20 input file is produced and TR-20 can be executed from within the GISHydro2000 interface. The software currently serves as an interface to the USGS peak and hydrograph methods, TR-20, and HEC-1. Future enhancements will be creating a web-based version of this software, better reporting, and providing an ultimate development coverage through known zoning data. He indicated that a TR News article was produced documenting this software (see <http://trb.org/trb/publications/trnews/rpo/rpo.trn210.pdf>).
- J. Development and Comparison of Three Methods for Peak Flow Estimation in Maryland - Dr. Glenn Moglen, Univ. of MD, discussed the development and comparison of three methods for peak flow estimation in MD. Research team includes Will Thomas and Art Miller. The peak flow methods compared were fixed regions, L-moments, and region of influence. Data were collected for 150 gages with areas ranging from 0.1 to 820 mi<sup>2</sup> with a median of 11.4 mi<sup>2</sup> and gage records from 9 to 57 years with a mean of 24.8. Data were determined for 43 potential explanatory variables. Method I used fixed region boundaries but identified only 3 regions: Appalachian, Piedmont, and Blue Ridge/Western Coastal/Eastern Coastal. Explanatory variables were drainage area, % limestone, % forest (for 1985 conditions), and % imperviousness (for 1985). Method II (L-moments) is based on the method developed by Hosking and Wallace (see 1997 book by these authors). The peak discharge is the product of the L-mean and the quantile associated with a particular return period. Presented was the equation for the Appalachian region which is a function of drainage area and % forest cover. Quantiles are 0.82 (2 year), 1.7 (10 year), 3.55 (100 year), 5.61 (500 year). Method III (region of influence) selects n watersheds with the most similar characteristics to develop a

regression equation. Preliminary findings show drainage area, storage, and forest cover are best explanatory variables. The three different methods are being compared to see which method produces smallest errors. A report is being produced and the models will ultimately be incorporated into GISHydro2000.

- K. Review of Research Topics - Sterling Jones, FHWA, used a Power point presentation to discuss the status of projects:
1. Abutment Scour for Compound Channels (FHWA-RD-99-156) will be extended with NCHRP 24-20.
  2. Performance of bridges during floods - Dr. Dave Mueller has produced the final report, FHWA-RD-01-041 which was revised on 8/28/01 and includes new K4 factor. This FHWA/USGS project will be merged with NCHRP 24-14.
  3. Extrapolation of laboratory model scour results to field conditions - Dr. Max Sheppard, Univ. of FL, is conducting at Turner's Falls, MS. Large scale studies are planned for New Zealand.
  4. Effects of Gradation & Cohesion on Bridge Scour (FHWA-RD-99-189), revised 7/01.
  5. FHWA Hydraulics Laboratory
    - a. Complex Pier Scour - In partnership with Dr. Max Sheppard, new HEC 18 section developed
    - b. Scour & Scour Protection of Bottomless Culverts
    - c. Culvert Entrance Studies for SD, IA, FEMA
    - d. Stream Power Experiments - Extended the work of Steve Smith and George Annandale.
    - e. Woodrow Wilson Bridge 3-D Numerical Model Study and 30 model studies
    - f. Wisconsin bridges with a 96" sewer line below pile cap
    - g. Adaption of HYRISK for Risk Based Countermeasure Design
    - h. Hydraulics of environmentally sensitive culverts
    - i. Resolve HYDRA junction loss issues, as needed
  6. New web site for hydraulics research activities can be reached at [www.tfhr.gov](http://www.tfhr.gov)

## 11. CONCERNS OF THE STATES

- OK Te Ngo said that they are working on new manual with Roy Jorgensen.
- ON Saeed Choudhary said that the Canadian Society of CE is sponsoring a Hydrotechnical Division conference in October 2003. A new "Guide to Bridge Hydraulics" has been produced which is an update of 1973 manual and has again been edited by Charlie Neil. Available from Transportation Association of Canada. Consultant selection process started in January received a positive 9 month review.
- MN John Boynton noted that 25k public employees are on strike, that 50% consultants is the target, that light rail from airport to downtown is underway, and that they are concerned with a spring of historic relevance near Highway 55 tie to cross town.
- MD Steve Udzenski indicated that they are implementing LID practices, that Raja has implemented an asset management goal, that direction is changing from just design to include inspection/maintenance, and that they would like to add small storm drains to their program of pond maintenance.
- WY Bill Bailey said that they are updating their regression equation and reviewing region of influence method.
- AK Mark Miles noted that they have signed a MOA with Fish & Game, that they are developing a policy statement for bioengineering, that they have advertised for scour monitoring, that they are in last 6 months of update of regression equations with USGS, that they continue to support USGS with \$0.5M for gaging, that they have more plans than budget, and that they are returning to English units.
- NC Dave Henderson noted that they are completing general permit with USACE for emergency replacement, that they have screened unknown foundations to 1600 for more analysis, that they have not done SWM ponds in past and are now implementing BMPs on 3 regulatory watersheds,

that CZM is using infiltration basin, and that since it has been 7 years since NC12 design for Oregon inlet, the design is being reassessed. The delay will require \$20M for repair.

- PA Barry Newman reported that there is a lack of recognition of H&H in PADOT, that they have a training curriculum for hydraulics, that they are working on a drainage manual with Art Miller who is working on 4 chapters, that they are working on an E&S manual, that the scour evaluation program is developing a good database of information, and that they are returning to English (manual will be dual units).
- VA Steve Kindy noted that they are reviewing final draft of new drainage manual which will be available on the web next year.
- FH Sterling Jones said that there will be a scour conference next year.
- IN Merrill Dougherty indicated that they have a new chief engineer, that they have changed back to English units and their manual is in SI units, that they are starting on phase 2 of SWM and will be applying for a separate permit for DOT, that the scour evaluation program will be completed at the end of the month, and that they have a budget revenue shortfall.



## AASHTO TASK FORCE MEMBERS/MEMBER'S REPRESENTATIVES (October 11, 2001)

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## AASHTO TASK FORCE MEMBERS/MEMBER'S REPRESENTATIVES (October 11, 2001)

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| Dr. Duc minh Tran  | Ministère des Transports du Québec<br>930 Chemin Sainte-Foy<br>7è étage Ville Québec<br>Province Québec, Canada G1S 4X9       | (418) 644-0894<br>FAX 646-5415<br>mdtran@mtq.gouv.qc.ca             |
| Mr. Raja Veeramachaneni<br>Chief, Highway Hydraulics<br>Division       | Maryland State Highway Adm.<br>707 N. Calvert St, C-201<br>Baltimore, Maryland 21202  | (410) 545-8390<br>FAX 209-5031<br>rveeramachaneni@sha.state.md.us   |

## AASHTO HIGHWAY SUBCOMMITTEE ON DESIGN OFFICERS

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| Ms. Susan Martinovich (Vice Chair)<br>Assistant Director, Engineering         | NEVADA DOT<br>1263 S. Stewart Street<br>Carson City, NV 89712                | (702) 888-7440<br>FAX 888-7201<br>smartinovich@dot.state.nv.us  |
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| Mr. Jim McDonnell, Associate<br>Program Director for Engineering              | AASHTO, Suite 249<br>444 North Capitol Street, NW.<br>Washington, D.C. 20001 | (202) 624-5448, FAX 624-5469<br>jimm@ashto.org                  |

**VISITORS**

Timonium, Md, October 1-5, 2001

| <b><u>NAME</u></b> | <b><u>ADDRESS</u></b>  | <b><u>TELEPHONE/FAX/EMAIL</u></b>                                |
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| Veronica Ghelardi  |  | 410-545-8326 vghelardi@...md.us                                  |

**AASHTO TASK FORCE ON HYDROLOGY AND HYDRAULICS****Fall 2001 MEETING**

Timonium, Md, October 1-5, 2001

**AGENDA**

|                   |  |   |
|-------------------|--|---|
| Monday<br>10/1    | <ul style="list-style-type: none"> <li>! Status of Task Force projects</li> <li>! FHWA Activities &amp; Updates</li> <li>! Scour Update</li> <li>! HDG 11, Coastal Zone</li> <li>! NCHRP 15-23 Project Overview</li> <li>! NCHRP 15-23 Recommended Changes</li> <li>! MDM Review of Changes</li> </ul>   | <ul style="list-style-type: none"> <li>Phil Thompson</li> <li>Phil Thompson</li> <li>Phil Thompson</li> <li>Dr. Billy Edge</li> <li>Ken Shearin</li> <li>Don Potter</li> <li>Chapter Chairs</li> </ul>  |
| Tuesday<br>10/2   | <ul style="list-style-type: none"> <li>! NCHRP Update</li> <li>! MDM Review of Changes</li> <li>! HDG Review of Changes</li> </ul>   | <ul style="list-style-type: none"> <li>Tim Hess</li> <li>Chapter Chairs</li> <li>Volume Chairs</li> </ul>   |
| Wednesday<br>10/3 | <ul style="list-style-type: none"> <li>! Field trip</li> </ul>   | <ul style="list-style-type: none"> <li>All</li> </ul>   |
| Thursday<br>10/4  | <ul style="list-style-type: none"> <li>Technical Presentations</li> <li>! Stormwater Design Manual</li> <li>! LID Approach for Stormwater &amp; Retrofits</li> <li>! NPDES Source Identification</li> <li>! SWM Facility Inspection</li> <li>! Stream Restoration in-lieu of SWM</li> <li>! Fluvial Geomorphology in Culvert Design</li> <li>! Groundwater Studies to Protect Bog Turtles</li> <li>! Hydrologic Analyses Criteria in MD</li> <li>! GIS-HYDRO Application for MD</li> <li>! Region of Influence Approach for MD</li> <li>! Review of Research Topics</li> </ul> | <ul style="list-style-type: none"> <li>Ken Pensyl</li> <li>Neil Weinstein</li> <li>Sonal Sanghavi</li> <li>Sonal Sanghavi &amp; William Park</li> <li>Karuna Pujara</li> <li>Stan Davis &amp; Andy Kosicki</li> <li>Stephen Buckley &amp; Kelly Brennan</li> <li>Will Thomas</li> <li>Dr. Glen Moglen</li> <li>Dr. Glen Moglen</li> <li>Sterling Jones</li> </ul> |
| Friday<br>10/5    | <ul style="list-style-type: none"> <li>! Business Meeting</li> <li>! Concerns of the States</li> </ul>   | <ul style="list-style-type: none"> <li>All</li> <li>All</li> </ul>  |

**GOALS AND TARGET DATES FOR COMPLETION (October 2001)**AASHTO (202) 624-5800, [www.transportation.org](http://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)****4<sup>th</sup> 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     | Miles            |
| 3          | Erosion Control | Henderson    | 11         | Coastal Zone      | [Veeramachaneni] |
| 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               | Final draft for SOD review |
|            | Chronicles         | Ghere/Thompson | 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 [2<sup>nd</sup>] - WP6.1, 1248 pg, Cost \$360 (\$300 to members)****2000 Appendix 7E & 15G \$40 ( \$34 to members)****[3<sup>rd</sup> 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      |                          | 12 STORAGE (SWM) | Dougherty                      | Ghere, Veeramachaneni |
| 2 LEGAL        | Richardson    |                          | 13 STORM DRAIN   | Bailey                         | Bryson, Reese         |
| 3 POLICY       | Nishioka      | Ngo, Richardson          | 14 PUMP STATION  | Ghere                          | DeCou, Reese          |
| 4 DOC.         | DeCou         | Ghere, Bailey            | 15 ENVIRONMENT   | Miles                          | Henderson, Newman     |
| 5 PLANNING     | Landry        | Richardson, Tran         | 16 EROS. & SED.  | Henderson                      | Dougherty             |
| 6 DATA COL.    | Reese         | Nishioka, Veeramachaneni | 17 BANK PROTECT  | Newman                         | Choudhary             |
| 7 HYDRO.       | Boynton       | Newman, Stolpha          | 18 COASTAL ZONE  | [Veeramachaneni]               | Henderson             |
| 8 CHANNELS     | Bryson        | Choudhary                | 19 CONSTRUCTION  | Ngo                            | Richardson, Landry    |
| 9 CULVERTS     | Thompson      | Ngo, Bryson              | 20 MAINTENANCE   | Richardson                     | Bryson, Henderson     |
| 10 BRIDGE      | Mills         | Nishioka, Landry         | 21 RESTORATION   | (only in 1991 & 1999 editions) |                       |
| 11 ENERGY      | Thompson      | Newman, Ngo              | Glossary         | Bailey                         | Thompson, Landry      |

## AASHTO TASK FORCE ON HYDROLOGY AND HYDRAULICS (October 2001)

[www.transportation.org/aashto/home.nsf/FrontPage](http://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, *draft has been approved.*
    - 2001, NCHRP 15-23 [www4.nationalacademies.org/trb/crp.nsf/rfps](http://www4.nationalacademies.org/trb/crp.nsf/rfps)
    - 2001, Fall, review and discuss list of recommended changes prepared by Roy Jorgensen Associates.
  
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](http://www4.nationalacademies.org/trb/crp.nsf/rfps)  
2001, Fall, review and discuss list of recommended changes prepared by Roy Jorgensen Associates.

**TOTAL HIGHWAY BRIDGES AS OF 4/15/01 (9/20/01)**

**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         | 14058                  | 5395            | 0        | 2030     | 7425   | 3636              | 2846                | 0     | 151            | 14058          | 100 | 7576              | 3636                  | 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         | 15386                  | 2910            | 2507     | 5536     | 10953  | 412               | 3661                | 29    | 324            | 15379          | 100 | 8770              | 2926                  | 75  |
| 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         | 8240                   | 1704            | 651      | 2583     | 4938   | 141               | 2776                | 137   | 248            | 8240           | 100 | 4535              | 792                   | 85  |
| GA         | 12145                  | 5331            | 0        | 732      | 6063   | 0                 | 6006                | 0     | 76             | 12145          | 100 | 6139              | 0                     | 100 |
| HI         | 860                    | 130             | 50       | 566      | 746    | 24                | 11                  | 2     | 64             | 847            | 98  | 760               | 87                    | 90  |
| IA         | 23557                  | 3151            | 757      | 14359    | 18267  | 96                | 4282                | 0     | 912            | 23557          | 100 | 18422             | 853                   | 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         | 23802                  | 6062            | 89       | 15682    | 21833  | 1435              | 93                  | 0     | 440            | 23801          | 100 | 22184             | 1525                  | 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         | 2465                   | 250             | 0        | 689      | 939    | 250               | 408                 | 1     | 867            | 2465           | 100 | 1806              | 250                   | 88  |
| 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         | 3578                   | 154             | 304      | 1289     | 1747   | 34                | 1746                | 0     | 51             | 3578           | 100 | 1494              | 338                   | 82  |
| NC         | 14085                  | 4359            | 31       | 3146     | 7536   | 4                 | 6379                | 82    | 84             | 14085          | 100 | 7589              | 35                    | 100 |
| ND         | 4141                   | 760             | 99       | 925      | 1784   | 7                 | 2276                | 0     | 74             | 4141           | 100 | 1759              | 106                   | 94  |
| NE         | 14866                  | 2723            | 9        | 2551     | 5283   | 1232              | 7999                | 0     | 325            | 14839          | 100 | 5599              | 1268                  | 82  |
| NH         | 1755                   | 163             | 80       | 1388     | 1631   | 30                | 50                  | 0     | 44             | 1755           | 100 | 1595              | 110                   | 94  |
| NJ         | 3551                   | 316             | 0        | 2421     | 2737   | 49                | 385                 | 48    | 332            | 3551           | 100 | 3069              | 49                    | 98  |
| NM         | 3001                   | 1563            | 172      | 671      | 2406   | 73                | 498                 | 0     | 24             | 3001           | 100 | 2258              | 245                   | 90  |
| NV         | 889                    | 555             | 31       | 114      | 700    | 33                | 53                  | 0     | 102            | 888            | 100 | 771               | 65                    | 92  |
| NY         | 12101                  | 1579            | 0        | 9469     | 11048  | 98                | 198                 | 68    | 689            | 12101          | 100 | 11737             | 98                    | 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         | 5457                   | 244             | 0        | 1727     | 1971   | 18                | 1918                | 70    | 1480           | 5457           | 100 | 3451              | 18                    | 99  |
| PA         | 17374                  | 1662            | 978      | 6924     | 9564   | 2032              | 654                 | 0     | 5095           | 17345          | 100 | 13681             | 3039                  | 82  |
| PR         | 1605                   | 244             | 63       | 758      | 1065   | 26                | 372                 | 33    | 109            | 1605           | 100 | 1111              | 89                    | 93  |
| 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         | 5376                   | 1001            | 0        | 1654     | 2655   | 135               | 2586                | 0     | 0              | 5376           | 100 | 2655              | 135                   | 95  |
| TN         | 16520                  | 7816            | 0        | 6022     | 13838  | 391               | 1236                | 0     | 1055           | 16520          | 100 | 14893             | 391                   | 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         | 5157                   | 145             | 0        | 3729     | 3874   | 72                | 305                 | 0     | 906            | 5157           | 100 | 4780              | 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         | 1946                   | 393             | 15       | 1063     | 1471   | 34                | 454                 | 0     | 2              | 1961           | 101 | 1458              | 34                    | 98  |
| Nationwide | 481251                 | 109533          | 1060     | 228835   | 344480 | 21156             | 88686               | 839   | 25858          | 481019         |     | 364226            | 27500                 |     |
| Percent    |                        | 22.8%           | 0.2%     | 47.6%    | 71.6%  | 4.4%              | 18.4%               | 0.2%  | 5.4%           | 100.0%         |     | 93.0%             | 7.0%                  |     |

## TECHNOLOGY APPLICATIONS (October 2001)

[www.fhwa.dot.gov/bridge/hyd.htm](http://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. (*Contract ended in FY2001.*)
  - ! Task awarded for dual unit conversion of HDS 4, HDS5 and HEC 22.
  - ! HDS 5 has been reviewed 9/01, HDS 4 and HEC 22 have been printed HEC 22 is at Isddc..
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 (beta received).
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.
  - ! WMS interface for HYDRA awarded summer 2001. FLOID interface is proposed for 2002.
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/hydsoft.htm](http://www.fhwa.dot.gov/bridge/hydsoft.htm).
  - ! Zen Jao (CALTRANS) completed Visual Urban version which is also available (*revision posted 9/01*).
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 & HEC 24 printed. Beta software has been 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](http://www.fhwa.dot.gov/bridge/hydpub.htm)
  - ! New reports are being provided in PDF format and historic reports are being scanned.
7. HEC Conversion to Dual Units (**Pagán**, Jones, Arneson, Krolak)
  - ! Funds provided for NHI task order for finalizing HEC 18 (4<sup>th</sup> Ed.), HEC 20 (3<sup>rd</sup> Ed.) and HEC 23 (2<sup>nd</sup> Ed.). HEC 18, HEC 20 and 23 printed in early May 2001, being converted to Word format.
  - ! Lesson plans complete for updating NHI 135046 Scour Course and developing a 2<sup>nd</sup> 3 day course, NHI 135048 Countermeasure Design (HEC 23 and DP 97)
8. HEC 9, Design of Debris Control Structures (**Beucler**, Thompson) - West Consultants, PI Dennis Richards.
  - ! Kick off meeting has been held 4/01.
9. HEC 25, Tidal Hydrology and Hydraulics (**Arneson**, Pagán) - Ayres (Dr. Lyle Zevenbergen) tidal pool funded project contractor awarded task to convert project material to HEC format.
10. CAESAR Manual (**Pagán**, Arneson) - Dr. Richard Palmer, University of Washington awarded contract 9/01 to develop manual and customize CAESAR for use by State DOTs.
11. Convert HEC 18, 20, and 23 to Spanish (**Pagán**) - pool funded project with NHI, International & HIBT



## NATIONAL HIGHWAY INSTITUTE (October 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/coursecfff.htm](http://www.nhi.fhwa.dot.gov/coursecfff.htm) and [www.fhwa.dot.gov/bridge/hydtrain.htm](http://www.fhwa.dot.gov/bridge/hydtrain.htm)

1. NHI 135010, Highways in the River Environment, 5 days (**Phil 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](http://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 HDS 6, HIRE manual has been reviewed. Final draft manual has been received.
2. NHI 135027, Urban Drainage Design, 3 days (**Dan Ghere**), 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 dual units is available at [isddc.dot.gov](http://isddc.dot.gov).
  - ! NHI 135028, Pump Station Design, is available. HEC 24 is available at [www.fhwa.dot.gov/bridge/hydpub.htm](http://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/hydssoft.htm](http://www.fhwa.dot.gov/bridge/hydssoft.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 (**Jorge Pagán**, Arneson, Sterling Jones, Joe Krolak, Nurmi, Ghere FHWA instructors); Ayres Associates (thru 5/31/2002) instructors are **Lagasse**, Richardson, Johnny Morris, Arlo Waddoups and Zevenbergen.
  - ! NHI 13047, 1-day for bridge inspectors, is taught by Ayres.
  - ! HEC 18 (4th Ed), HEC 20 (3rd Ed) and HEC 23 (2nd Ed) are printed and are being converted to Word..
  - ! 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](http://isddc.dot.gov).
  - ! Metric HEC 14 in PDF format available at [www.fhwa.dot.gov/bridge/hydpub.htm](http://www.fhwa.dot.gov/bridge/hydpub.htm)
  - ! Course needs to be converted to dual units. Dual unit HDS 5 has been completed, n values are being reviewed.
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 was extended to 5/2002.
  - ! Error correction task is underway to produce version 6.2.
8. NHI 135065, Introduction to Highway Hydraulics, 3.5 days, (**Pagán**, Toillion, *Brian Beucler* FHWA instructors)
  - Ayres Associates instructors are **Schall**, Morris, Waddoups, Dave Frick, and Doug Leiho.
  - ! HDS 4 was distributed in July 1997 and the course is available. HDS 4 has been 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 - Draft updated and dual units HDS 2 has been completed and reviewed. Course is being updated.
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 2002 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**).
  - ! 1<sup>st</sup> pilot in CA in 8/2000 and 2<sup>nd</sup> pilot in PA in 11/2000. Course is available.

**FHWA Hydraulic Engineering Publications**  
**[www.fhwa.dot.gov/bridge/hydpub.htm](http://www.fhwa.dot.gov/bridge/hydpub.htm)**  
**October 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](http://www.fedworld.gov/ntis)). Electronic versions for some publications are available at DOT digital document center: [isddc.dot.gov](http://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 (Dual Units)                                     | 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 (Dual units)                                 | 2001 | NHI-01-001 |             |
| HEC-20                                | Stream Stability at Highway Structures, Edition 2 (Dual units)                      | 2001 | NHI-01-002 |             |
| HEC-21                                | Bridge Deck Drainage Systems  | 1993 | SA-92-010  | PB94-109584 |
| HEC-22                                | Urban Drainage Design Manual (Dual Units)   | 2001 | NHI-01-021 |             |
| HEC-23                                | Bridge Scour & Stream Instability Countermeasures (Dual Units)                      | 2001 | NHI-01-003 |             |
| 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  |             |

\* Also available from McTRANS - 512 Weil Hall, Univ. of Florida, Gainesville, FL 32611-6585  
352- 392-0378, FAX 352- 392-3224, Messages 1-800-226-1013

\*\* Available from Pallas, Inc - 8 Inverness Drive Et., Suite 245, Englewood, CO 80112  
303-790-9001, FAX 303-790-9008 or [www.pallasinc.com](http://www.pallasinc.com)

**FHWA Hydraulics Software List**  
**[www.fhwa.dot.gov/bridge/hydrsoft.htm](http://www.fhwa.dot.gov/bridge/hydrsoft.htm)**  
**October 2001**

The software and related publications listed below are available at [www.fhwa.dot.gov/bridge/hydrsoft.htm](http://www.fhwa.dot.gov/bridge/hydrsoft.htm) or:

McTRANS - 512 Weil Hall, Univ. of Florida, Gainesville, FL 32611-6585, (352) 392-0378, FAX (352) 392-3224, Messages 1-800-226-1013 ([www-mctrans.ce.ufl.edu](http://www-mctrans.ce.ufl.edu))

PC-TRANS - 2011 Learned Hall, Lawrence, KS 66045, (913) 864-5655, FAX (913) 864-3199 ([kuhub.cc.ukans.edu/~pctrans/index.html](http://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) [Version 2 ACPA]         | 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     | Flo2DH (Version 3.01) [available with course] | 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)                        | 2001  |            |            |             |
| 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 |             |