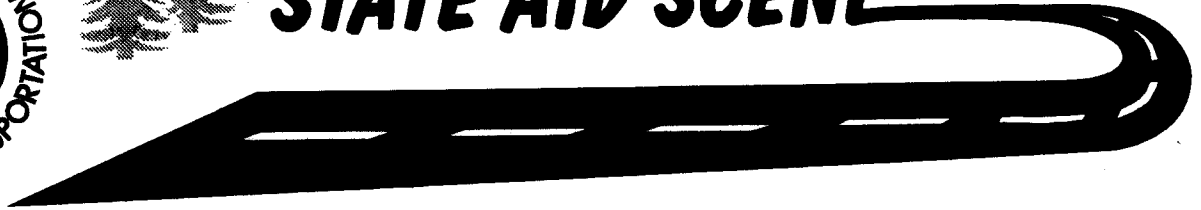




STATE AID SCENE



Number 26

State Aid Division

April 1999

PLANS ACCEPTABLE IN ENGLISH OR METRIC

by Paul Stine

Use of English units on state-aid and federal-aid plans is allowed per Technical Memorandum 99-SA-01. Bills requiring the use of English units have been proposed at the State Legislature, but are unnecessary as far as state-aid funding because of the acceptance of English units as expressed in the Technical Memorandum.

MCEA TECHNICIAN CERTIFICATION COMMITTEE MEETS WITH Mn/DOT STAFF

by Paul Stine

The MCEA technician certification committee met with Mn/DOT staff on March 31. Committee members include Mitch Anderson (Chair), Steve Backowski, Doug Fischer, Dave Rholl, Rich Sanders, Andy Sander, Dave Halbersma, Guy Kohlenhofer, and Dave Christy. The Committee met with Bill Servatius - Construction Programs Coordinator, Art Peroutky - Technical Certification Specialist, Mike Sheehan - MCEA President, Mike Pinsonneault, and Paul Stine. The purpose of the meeting was to familiarize the committee members with the operation of the Technical Certification Program and to discuss possible improvements.

The program includes approximately 1300 Mn/DOT persons, 2000 contractor staff, 1300 city/county staff, and 900 consultants. It is expected to continue to expand. After passing initial certification, recertification is required every

five years. Program managers strive to provide the highest quality training for minimal overall cost. Hands-on training is provided by highly qualified instructors that have long-term field experience. The instructors include national experts from other states, Mn/DOT material specialists, technical school instructors, industry experts, and retired inspectors, material testers, and engineers. This year they provided 85 initial certification courses and 20 recertification courses. Typically initial certification courses last between two to five days and cost between \$150 and \$250. The half- or full-day recertification courses cost \$50 to \$100. The prime period to hold classes is December through March.

The three main issues discussed were providing more courses, providing more courses at out-state Districts, and handling the situation where a person's certification is about to expire but recertification classes are filled.

The courses that fill up the fastest are Aggregate Production and Grading & Base. It is believed that Aggregate Production is popular due to the new bituminous specs that emphasize aggregate quality. Mn/DOT's Transportation Generalist Series program has increased the number of applicants. The Department is considering training in the summer for Transportation Generalists who do not perform testing. Enrollment is reserved at one-third for Mn/DOT staff, one-third for county/city staff, and one-third for contractor/consultant staff. A training needs survey has been used in the past to estimate initial certification course needs but response to

the survey failed to reflect actual registration. It was recommended that this year the needs survey and actual registration be integrated or directly related, perhaps giving respondents priority. Recertification course needs are estimated based on yearly analysis of certification database output. It was noted that it may take several weeks by the time the county receives the course registration form, sends it to the appropriate staff, staff fills out the form, sends it to the county engineer who takes it to their board for approval, and then mails it back to Mn/DOT staff. This makes it difficult for county staff to respond soon enough to the high demand course registration.

Experience has shown that out-state courses have not always filled up while metro courses fill quickly. Courses are provided at outstate locations but there are requests to provide more. Many of the fee instructors are paid per person, therefore it is not cost effective to travel outstate to train a small number. When outstate classes are short of registrants, Art does contact Mn/DOT staff to ask if additional inspectors may sign up. Video conferencing has been tried in the past, but travel was still necessary for the hands-on materials test. For instructors from Mn/DOT's Material office, it is a matter of the amount of time teaching takes from their regular work. Art is currently pursuing a "train-the-trainer" approach to move more classes to District locations. Bill and Art have worked with Technical Colleges in the past but found that the instructors they proposed to use do not have the hands-on materials experience required by Mn/DOT and FHWA. Art has recently contacted several Technical Colleges to examine the possibility of using their facilities while Mn/DOT provides instructors.

For persons whose certification is to expire, they can get provisionally certified for an additional year. Also, anyone can simply test-out in lieu of attending recertification courses (see handbook for details). Approximately two-thirds of persons

who try the test-out option pass. The committee recommended giving course registration priority to those who are provisionally certified. It was noted that sometimes inspectors fail recertification tests but do not inform supervisors, therefore the City or County Engineer may want Technical Certification Cards reviewed before assigning staff to projects.

Also discussed was having instructors provide feedback immediately after the test so that persons could know where they may need additional review. For the larger courses, it is not feasible to correct tests on the spot, and most persons leave immediately after handing the test in. Returning the corrected test is undesirable since the questions are likely to be used again. Art will suggest to instructors of smaller size courses that they allow persons to stay after the test to go over results with the instructors.

Rich Sanders agreed to attend Mn/DOT's Technician Certification Instructors meetings to provide a local agency perspective. The MCEA Technical Certification Committee will meet again next September, prior to mailings of course notices, to see how suggestions discussed were implemented. The Committee will continue to meet to help develop a more successful and responsive Technical Certification Program.

STATE AID OPERATIONS RULES ON THE WEB

To access the Rules on the Internet, go to State Aid's web site at "www.dot.state.mn.us/stateaid" (note: no spaces); then click on "Links", then "Minnesota Legislature", then "Minnesota Rules", then "Retrieve a rules chapter". Type in "8820" where directed, press enter, and wallah - you have the latest version of the Rules to read or print.

REVISED FLEXIBLE PAVEMENT CHART

Portions of the chart in the metric State Aid Manual titled "Flexible Pavement Design Using Soil Factors" are inaccurate. The errors occurred while converting the chart to metric dimensions. Because of the significance of this chart, a revised copy is attached for immediate use. A revised manual page will be transmitted shortly.

OVERTOPPING, DESIGN FREQUENCY GUIDELINES FOR BRIDGES

The design flood for bridges is equal to the overtopping flood or Q_{100} , whichever is less. See State Aid Manual .225 D. In Minnesota, all bridges are designed the same regardless of ADT. It is the overtopping frequency that is selected based on ADT. The overtopping frequency should be arrived at by using the risk assessment. Risk assessment instructions put out by the MnDOT Hydraulics Section include recommended minimum overtopping frequencies. When the overtopping frequency is much higher than these minimums, the design will be revisited unless a required profile grade or a high existing grade dictate a higher frequency. The term Design/Overtopping Flood, rather than just Design Flood may be preferable when there is overtopping. A design flood that is not the same as the overtopping or 100 year flood is irrelevant to the bridge design. For more information contact Brian Rudie with the State Aid Bridge Unit at (651) 582-1193.

VARIANCE MEETING

Next variance meeting is scheduled for Wednesday, June 23, 1999 at Arden Hills Training Center, Room 3 from 9:00 a.m. to 11:30 a.m. Deadline to submit variance requests is June 1.

USE OF CORRUGATED POLYETHYLENE PIPE FOR STORM SEWER

Recently Mn/DOT issued a Technical Memorandum regarding the use of dual-wall corrugated polyethylene pipe for storm sewer. All county and city engineers received a copy of this Technical Memorandum. Included with the Technical Memorandum was an installation drawing and special provisions which provide details regarding materials, installation, and testing. The information is both in English and metric units.

It is recommended that if corrugated polyethylene pipe is specified for use on the State Aid projects, that the information in this Technical Memorandum along with the installation drawing and special provisions be used. A copy of the Technical Memorandum and the attachments are enclosed. If you have any questions or concerns, please contact Khani Sahebjam at 651-296-7679, or John Boynton, Hydraulics Engineer at 651-582-1187.

REPORT OF STATE AID CONTRACT AND FINAL ESTIMATE FORMS

by Paul Stine

Revised versions of the "Report of State Aid Contract" and "Final Estimate" forms have been developed and are attached for your use. The new versions were developed with input of city and county finance staffs, State Aid Finance staff, and the District State Aid Engineers and assistants. The purpose of the revision was to eliminate ambiguity, minimize the number of errors, and avoid delays in making payments. Use of the revised forms is strongly encouraged. The revised forms will be discussed at the upcoming accountant's meeting.

NEW MATERIALS TRAINING

Attached you will find information on new materials training available through the District State Aid Offices

PLAN SIZES

Please, Please, Please!

Anyone submitting plans to our office and the districts, they must be either 22 x 34 or 11 x 17. Anything other than these sizes will result in delay of processing. They cannot be copied in reprographics and will be sent back to the local agency to reduce.

NEW FACES - NEW PLACES

The Federal Aid section would like to introduce **Jill Liska-Kusie**, who replaces Bob Vasek. Bob is now working for the Maintenance Office. Jill is a grad 2 and has worked for Mn/DOT four years starting as a student worker. She did her rotation in Water Resources, Construction, Surveys, City of Minneapolis, GIS, Pre-Design and Final Design. Jill earned her Engineering Degree from the University of Minnesota. State Aid Bridge Engineer **Darab Bouzarjomehri** has accepted a job in California with the San Diego Port Authority, Brian Rudie is acting State Aid Bridge Engineer until the position is filled permanently. **Brad Kennedy** in Finance has accepted a promotion with MnSCU in Moorhead, his last day is April 22. **Patti Loken** will replace Greg Coughlin in Metro State Aid.

SPRING SCREENING BOARD MEETING

Maddens Resort, Brainerd

June 2 - 4, 1999

DSAE - Wednesday, June 2nd
9:00 a.m. - noon
MSAS - Wednesday, June 2nd
1:00 p.m. - 4:30 p.m.
Thursday, June 3rd
8:00 a.m. - noon
CSAH - Thursday, June 3rd
1:00 p.m. - 4:30 p.m.
Friday, June 4th
9:00 a.m. - noon

Don't forget about our web page at:

www.dot.state.mn.us/stateaid/

FLEXIBLE PAVEMENT DESIGN USING SOIL FACTORS

Required Gravel Equivalency (G.E.) for various Soil Factors (S.F.)

For new construction use projected ADT. For resurfacing use present ADT. All units of G.E. are in inches with millimeters in parentheses.

6.4 TON - LESS THAN 400 ADT			8.2 TON - 150-300 HCADT			8.2 TON - MORE THAN 1100 HCADT		
S.F.	Minimum Bit. G.E.	Total G.E.	S.F.	Minimum Bit. G.E.	Total G.E.	S.F.	Minimum Bit. G.E.	Total G.E.
50	3.0 (75)	7.25 (180)	50	7.0 (175)	14.00 (350)	50	8.0 (200)	20.30 (510)
75	3.0 (75)	9.38 (235)	75	7.0 (175)	17.50 (440)	75	8.0 (200)	26.40 (660)
100	3.0 (75)	11.50 (290)	100	7.0 (175)	21.00 (525)	100	8.0 (200)	32.50 (815)
110	3.0 (75)	12.40 (310)	110	7.0 (175)	22.40 (560)	110	8.0 (200)	35.00 (875)
120	3.0 (75)	13.20 (330)	120	7.0 (175)	23.80 (595)	120	8.0 (200)	37.40 (935)
130	3.0 (75)	14.00 (350)	130	7.0 (175)	25.20 (630)	130	8.0 (200)	39.80 (995)
6.4 TON - 400 - 1000 ADT			8.2 TON - 300-600 HCADT			GRAVEL EQUIV.		
S.F.	Minimum Bit. G.E.	Total G.E.	S.F.	Minimum Bit. G.E.	Total G.E.	MATERIAL*	TYPE OF MATERIAL	EQUIV.
50	3.0 (75)	9.00 (225)	50	7.0 (175)	16.00 (400)	Plant-Mix Bit.	Type 41, 61	2.25
75	3.0 (75)	12.00 (300)	75	7.0 (175)	20.50 (515)	Plant-Mix Bit.	Type 31	2.00
100	3.0 (75)	15.00 (375)	100	7.0 (175)	25.00 (625)	Road-Mix Bit.	Spec 2321	1.50
110	3.0 (75)	16.20 (405)	110	7.0 (175)	26.80 (670)	Bit. Treat. Base	Spec 2204rich/lean	1.50/1.25
120	3.0 (75)	17.40 (435)	120	7.0 (175)	28.60 (715)	Aggregate Base	(Cl. 5 & 6) 3138	1.00
130	3.0 (75)	18.60 (465)	130	7.0 (175)	30.40 (760)	Aggregate Base	(Cl. 3 & 4) 3138	0.75
130	3.0 (75)	18.60 (465)	130	7.0 (175)	30.40 (760)	Select Granular	Spec 3149.2B	0.50
8.2 TON - LESS THAN 150 HCADT			8.2 TON - 600 - 1100 HCADT			AASHTO SOIL CLASS		
S.F.	Minimum Bit. G.E.	Total G.E.	S.F.	Minimum Bit. G.E.	Total G.E.	SOIL FACTOR (S.F.) %		
50	7.0 (175)	10.25 (255)	50	8.0 (200)	18.50 (465)	A - 1	50 - 75	70 - 75
75	7.0 (175)	13.90 (350)	75	8.0 (200)	23.70 (595)	A - 2	50 - 75	30 - 70
100	7.0 (175)	17.50 (440)	100	8.0 (200)	29.00 (725)	A - 3	50	70
110	7.0 (175)	19.00 (475)	110	8.0 (200)	31.10 (780)	A - 4	100 - 130	20
120	7.0 (175)	20.50 (515)	120	8.0 (200)	33.20 (830)	A - 5	130 +	--
130	7.0 (175)	22.00 (550)	130	8.0 (200)	35.30 (885)	A - 6	100	12
						A - 7 - 5	120	12
						A - 7 - 6	130	10

NOTE: If 10 ton (9.1 t) design is to be used, see Road Design Manual 7-50 (10) & 7-50 (12).

For full depth bituminous pavements, see Road Design Manual 7-50 (12).

* Granular Equivalent Factors per MnDOT Technical Memorandum 98-02-MRR-01.

MINNESOTA DEPARTMENT OF TRANSPORTATION
Engineering Services Division
Technical Memorandum No. 98-24-B-01

TO: Distribution 57, 612, 618, 650

FROM: David S. Ekern *dse*
Director/Assistant Chief Engineer
Engineering Services

SUBJECT: USE OF DUAL-WALL CORRUGATED POLYETHYLENE
PIPE FOR STORM SEWER ON TRUNK HIGHWAYS

This Technical Memorandum is a reissue with minor revisions of Technical Memorandum No. 95-14-B-02. This Technical Memorandum shall continue in force until December 31, 1999, or until superseded or suspended.

Dual-wall corrugated polyethylene pipe may be used as an alternate to reinforced concrete pipe for use as storm sewer for pipe sizes of 300 mm - 900 mm diameter (English special provisions are attached). The pipe may be used on all trunk highways.

The corrugated polyethylene pipe shall conform to the requirements of AASHTO M294 and Design Section 18 of the AASHTO Standard Specifications for Highway Bridges except as modified by this Memorandum. The joints of the corrugated polyethylene pipe shall be coupled to provide a soil-tight joint. When Design 3006 reinforced concrete pipe is required in the plan, a water-tight joint shall be provided for in the corrugated polyethylene pipe. Corrugated polyethylene pipe shall be installed according to Specification 2503, except as modified by this Memorandum and the attached Special Provisions.

The installation of corrugated polyethylene pipe is based on being placed in a trench where the soil is dry and well-compacted. It is necessary that the backfill for the corrugated polyethylene pipe be compacted against firm soil materials. The designer should refer to ASTM D 2321 for additional information on backfilling procedure if the soil material in the trench walls is not firm, ground water is present, or any other conditions are encountered that may make it difficult to provide adequate vertical and horizontal support for the pipe.

Dual-wall corrugated polyethylene pipe and reinforced concrete pipe shall normally be provided in plans as alternates. The storm sewer tabulation sheets shall show which reaches of pipe are to be installed as alternates. The estimate sheet shall provide for the reinforced concrete pipe and corrugated polyethylene pipe alternates.

For information on the contents of this memorandum contact John Boynton, Hydraulics Engineer, at 651/582-1187.

Any questions regarding the publication or distribution of technical memorandums should be referred to Andrew Halverson, Acting Design Standards Engineer 651/296-3023, or Helen Blair Administrative Assistant 651/296-2381.

Attachments

-END-

(2503) CORRUGATED POLYETHYLENE PIPE SEWER

This work shall consist of furnishing and installing dual-wall corrugated polyethylene pipe and fittings in accordance with the plans, Mn/DOT Specification 2503, AASHTO M294, Design Section 18 of the AASHTO Standard Specifications for Highway Bridges, and the following:

A. MATERIALS

Corrugated polyethylene pipe and fittings shall be manufactured from high density polyethylene (HDPE) virgin compounds. Clean reworked HDPE materials from the manufacturer's own production may be used by the manufacturer of HDPE pipe, provided that the pipe and fittings produced meet all requirements of these special provisions and in AASHTO M294 and Design Section 18 of the AASHTO Standard Specifications for Highway Bridges. The polyethylene compounds shall conform to the requirements of ASTM D 3350 Cell Class 335420C.

B. SECTION PROPERTIES

Wall thickness shall be the thickness of the inner liner measured between corrugation valleys of the outer rib wall. The wall thickness shall equal or exceed the minimum wall thickness values in Table 1.

The pipe stiffness shall be determined in accordance with AASHTO M294 at 5 percent deflection. The average pipe stiffness shall equal or exceed the minimum pipe stiffness value for each size of pipe listed in Table 1.

C. COUPLINGS

Connections may be made with bell and spigot joints or clamp-on-bands. If bell and spigot joints are utilized a gasket shall be incorporated to make the joint soil-tight. If clamp-on bands are utilized, a closed-cell expanded rubber or neoprene gasket shall be provided on one corrugation on each side of the joint. The band shall be securely lapped and fastened to prevent pipe movement and provide a soil-tight joint. Only ties provided by the pipe manufacturer may be used.

When a watertight joint is specified in the plans, it will be required that assembled joints be able to pass the following performance test without leakage at the joints:

Two sections of corrugated polyethylene pipe shall be fitted together with the gasket in place. Suitable bulkheads shall be provided at the outer ends of the two joined pipe sections. The pipe shall maintain an internal hydrostatic pressure of 68 kpa for ten minutes. The pipe manufacturer shall provide to the Project Engineer a laboratory certification that the pipe coupler for each size of pipe furnished meets this requirement. The manufacturer shall also provide to the Project Engineer shop drawings of the pipe coupler.

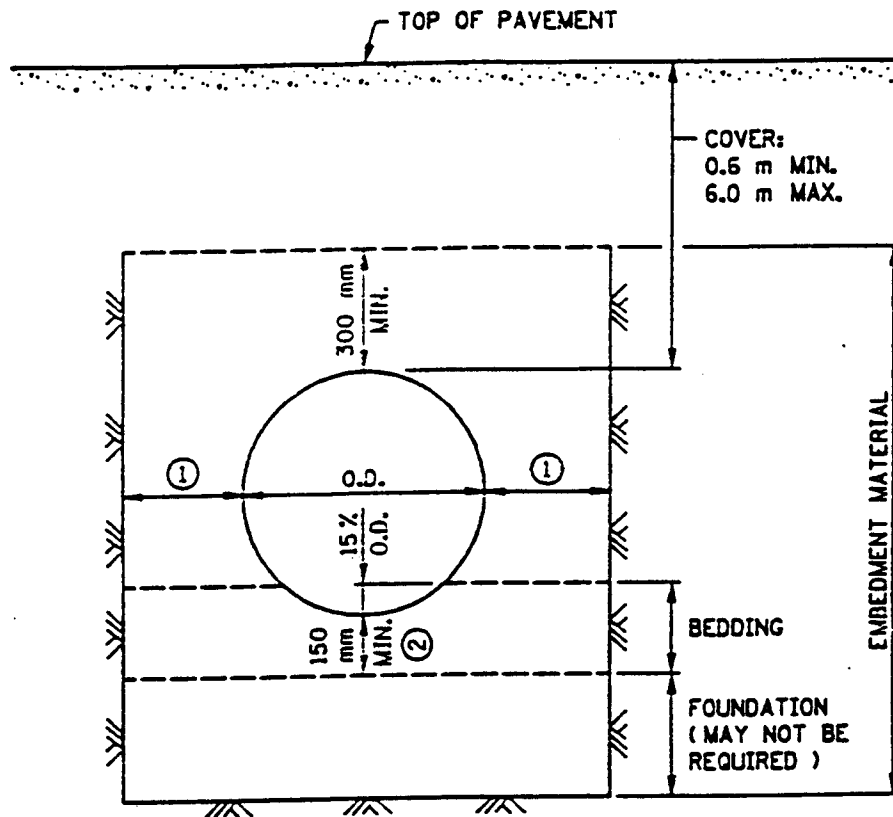
Pipe couplers shall be subject to rejection upon failure to conform to any requirements of this specification.

D. DEFLECTION TESTING

Deflection testing shall be performed by the Contractor using a nine point mandrel approved by the Engineer. The diameter of the mandrel shall be as shown on Table 2. Mandrel testing shall be done no less than thirty (30) days after installation or upon completion of construction of the roadway to the grading grade, whichever occurs first. The mandrel must be pulled through the pipe by non-mechanical means. Pipe through which the mandrel does not pass will be considered unacceptable. New pipe or deformed pipe which is not damaged shall be relaid. The relaid pipe shall be retested for deflection after no less than five (5) calendar days.

TABLE 1						
DUAL WALL CORRUGATED POLYETHYLENE PIPE						
NOMINAL DIAMETER (IN.)						
Properties	12	15	18	24	30	36
Min. I.D. (in.)	11.8	14.8	17.7	23.6	29.5	35.5
Max. O.D. (in.)	14.7	18.0	21.5	28.7	36.4	42.5
Min. Wall Area (in. ² /ft.)	1.50	1.91	2.34	3.14	3.92	4.50
Min. C (in.)	0.35	0.45	0.50	0.65	0.75	0.90
Min. I (in. ⁴ /in.)	.024	.053	.062	.116	.163	.222
Min. Pipe Stiffness (psi)	46	42	40	34	28	22
Min. Wall Thickness (in.)	.035	.035	.050	.050	.080	.100

TABLE 2	
PIPE DIAMETER (Inches)	MANDREL DIAMETER (Inches)
12	11.40
15	14.25
18	17.10
24	22.80
30	28.50
36	34.20



**PLASTIC PIPE INSTALLATION REQUIREMENTS
FOR STORM SEWER ONLY
(METRIC)**

NOTES:

MAXIMUM NOMINAL PIPE DIAMETER IS 900 mm.

EMBEDMENT MATERIAL PER SPEC. 3149.2D MODIFIED TO 100% PASSING THE 25 mm SIEVE.

CONSTRUCTION REQUIREMENTS PER SPEC. 2451 MODIFIED SO THAT EMBEDMENT MATERIAL IS COMPACTED IN UNIFORM LAYERS 200 mm OR LESS IN THICKNESS, LOOSE MEASUREMENT TO 95% STANDARD PROCTOR DENSITY.

BEDDING SHALL BE CLASS B PER SPEC. 2451.3.

- ① TRENCH WIDTH PER ASTM D2321, EXCEPT AS MODIFIED, TO PROVIDE 1/2 NOMINAL INSIDE PIPE DIAMETER OR 300 mm (WHICHEVER IS GREATER) ON EACH SIDE OF PIPE, TO ALLOW FOR COMPACTION.
- ② THE ZONE IMMEDIATELY BENEATH THE PIPE WHICH SHALL ONLY BE COMPACTED SUFFICIENTLY TO PROVIDE UNIFORM SUPPORT.

REFERENCE DATE: 8-13-97

REPORT OF STATE AID CONTRACT

S.A.P. No. _____ County/City _____
 (Submit one report for each project number)

Tied projects (if any): _____ Contractor name: _____
 _____ Contractor location (city): _____
 Local Proj ID # (optional): _____ Performance bonds by: _____

Total contract costs (all SAP's and local projects): \$ _____ Letting Date: _____

Project Funding: Funding below is for this project number only. Costs for projects or agreements tied to this project should not be included on this request. A separate Report of State Aid contract must be submitted for each project number.

Account Type *(see types below) _____

STATE AID CONTRACT COSTS:

Total contract costs (this SAP)	\$ _____	\$ _____	\$ _____
Less: ineligible	\$ _____	\$ _____	\$ _____
Less: eligible - local funds used	\$ _____	\$ _____	\$ _____
Force Account**	\$ _____	\$ _____	\$ _____
Subtotal contract costs	\$ _____	\$ _____	\$ _____

OTHER SA ELIGIBLE COSTS:

Project Development (PE/CE; 35% max)	\$ _____	\$ _____	\$ _____
Right of Way	\$ _____	\$ _____	\$ _____
Other _____	\$ _____	\$ _____	\$ _____
(specify)			

TOTAL FUNDS REQUESTED \$ \$ \$

Remarks _____

*Urban (MSAS), Regular (CSAH), Munic. (CSAH), Co. Turnback (CTB), Munic. Turnback (MTB), Town Bridge, Fund 29, State Park, SA Bonds
 **Include work by agency forces, MnDOT forces, locally furnished materials, railroad force account work, or utility force account work

I hereby certify that engineering costs requested above do not exceed actual costs. I hereby certify that the wage rates specified in the project contract equal or exceed the minimum hourly rates required for work on state funded construction projects as determined by the Minnesota Department of Labor and Industry. Payment and performance bonds for the full amount of the contract have been provided with aggregate liability of the bond(s) to twice the full amount of the contract.

SIGNED: _____ Date: _____
 County/City Engineer

APPROVED: _____ Date: _____
 District State Aid Engineer



Memo

Metropolitan Division - Development
2055 N. Lilac Drive
Golden Valley, MN 55422

Heather Hanzalik: 612-797-3043
Fax: 612-797-3181

Date: March 29, 1999

To: State Aid County and City Engineers

From: Heather Hanzalik, WordPerfect Specialist and Ellen G. Anderson, Project Manager
GeoMETRIC Design Training Project

Subject: Release of New Lessons: "Turning Movements at Intersections" and "Acceleration and Deceleration Lane Design"

The videos, along with master copies of the Teaching Guide and Trainee Workbook for the lessons cited above has been sent to your State Aid Engineer. There are now twenty one complete sets of lessons available. Closed captioned videos of some of these lessons may be checked out from the Mn/DOT Training Office by contacting Lonnie Cowherd (651)297-4429. Sample Workbook examples or design problems presented in these lessons include:

"Turning Movements at Intersections"

- Selecting the Appropriate Design Vehicle for Turning Path Design
- Determining the Appropriate Outside Turning Radius for Turning Path Design
 - Diagrams
- Providing the Right Turn Corner Radius
 - AASHTO Diagrams
 - Simple Curve and Simple Curve plus Taper
- Providing the Right Turn Corner Radius
 - Three-centered Compound Curve Radius
- Providing the Right Turn Corner Radius
 - Angle of Turn Other Than 90° - AASHTO Tables
 - Simple Curve and Curve with Taper
- Providing the Right Turn Corner Radius
 - Minnesota Nomograph
 - Simple and Compound Curve
- Determining the Appropriate Width for the Turning Path
- Determining the Need for Turn Lanes
- Determining the Need for Left Turn Lanes (Rural Multi-Lane Undivided)
- Determining the Need for Left Turn Lanes (Rural Two-Lane Roadways)
- Determining the Deceleration Length for a Turn Lane (Taper Included)

- Determining the Storage Length for a Turn Lane
 - Unsignalized Intersection
 - Left Turn
 - Right Turn/Stop Condition
- Determining the Storage Length
 - Signalized Intersection
 - Right Turn/Yield Condition
 - Left Turn
- Determining the Total Length of a Turn Lane
 - Unsignalized Intersection
 - Signalized Intersection
- Determining the Length of the Acceleration Lane for Turning Movements
- "Acceleration and Deceleration Lane Design"**
 - Determining the Length of a Deceleration Lane for Exits
 - Determining the Length of an Acceleration Lane for Entrances

To ensure full benefit is realized from this training material, encourage your staff to provide **time** to complete *all* the problems in the Workbooks and to review *all* the solutions and additional information in the Teaching Guides. People using a lesson without a trainer should use the appropriate Teaching Guide so they can refer to the teaching notes, **problem solutions, and additional lesson information.**

The CD conversion stage of this project is proceeding. Since this conversion is very far from being complete and because the quality of the converted material depends on information from users, encourage your staff to use new lessons as they are produced. This use will assist us in discovering any changes or additions that need to be made to the lessons *prior* to the conversion. The use and evaluation of these new lessons is an important part of the material development process. The corrections and suggestions made by users of earlier lessons have been appreciated. Send the suggested changes and a copy of the page from the lesson material that relates to the change to: Heather Hanzalik, Metro Mn/DOT , Development, 2055 N. Lilac Drive, Golden Valley MN, 55422.

State Aid cities, counties, and consultant State Aid engineers are expected to contact the State Aid office in their district to arrange to use the lessons. The guidelines for use of the materials by State Aid clients are as follows:

- 1) City and county employees may check out the lessons (the video and copies of the Teaching Guide and Workbook) to use in their own offices. The video must be returned to Mn/DOT. The length of time each video may be checked out is limited to provide access to the material by all cities and counties.
- 2) Consulting engineers working as State Aid engineers are to use the lessons in the Mn/DOT office. They are not to take the video out of the office. Since there is only one copy of each video per office, this restriction is necessary to

provide priority access for city and county employees. They may take their *copies* of the Teaching Guide and Workbook to their own offices, but they may not reproduce them.

3) Users may **not** reproduce any of this material, through any means, as it is copyrighted.

4) These lesson materials are not to be released to other agencies, consulting firms, or the general public at this time. Refer all such requests to Lonnie Cowherd at (651)297-4429.