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Consultant Design				
Action	Info	Date 6/14/07 Routing	Attach	Initial
	✓	Bureau Chief		
		Consultant plans Eng		
		Design Supervisor		
		CTEP Engineer		
	✓	ALL ENVIRONMENTAL STAFF		
	✓	ALL DESIGN CONSULTANTS		
	✓	File		

Memorandum

To: Distribution

From: Mark Goodman PE, Hydraulics Engineer MAG

Date: June 12, 2007

Subject: Alternative Culvert Pipe Material Selection Guidelines

With the December 15, 2006 revision to CFR 645.411 concerning alternate culvert pipe material selection, MDT decided to clarify our procedure with regard to this subject. As a result, MDT developed a procedure memorandum entitled *Pipe Material Selection Guidelines*.

FHWA participated in the development of these guidelines and has concurred with our procedure. The procedure memorandum and concurrence letter between MDT and FHWA are attached for distribution.

These guidelines will become part of the hydraulic design criteria for the development of MDT highway projects. The development of these procedure guidelines does not change our current policy but identifies the need for proper analysis and requires documentation of the material selection. Therefore, it will be important to adequately document the material selection process in all future preliminary and final hydraulic reports.

034:MAG:djh
Attachments

Distribution w/ Attach:

Loran Frazier - Engineering
Jim Walther - Engineering
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Damian Krings – Highways
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Kevin Christensen – Construction
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Jerry Michel – Hydraulics
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Jim Lynch, Director
Brian Schweitzer, Governor

April 25, 2007

Ted Burch
Program Development Engineer
Federal Highway Administration
2880 Skyway Drive
Helena, Montana 59602

Subject: 23 CFR 635.411
Alternate Pipe Material Selection

With the December 15, 2006 revision to CFR 645.411 concerning alternate culvert pipe material selection, MDT has decided to clarify with FHWA our procedure with regard to this subject. Attached is a procedure memorandum entitled Pipe Material Selection Guidelines, dated April 24, 2007.

The Memorandum does not constitute a change to our current policy but emphasizes the need for proper analysis and documentation of material selection. This will continue to encourage competitive bidding while resulting in well engineered cost-effective installations.

Two copies of the memorandum are attached for your concurrence. Please return one copy and keep the other for your files. We appreciate your assistance in developing these guidelines and please feel free to contact me if you have any questions or comments,.

Sincerely

James A. Walther

James Walther, PE
Preconstruction Engineer

FHWA Concurrence: Theodore J Burch Date: 06/06/2007

Attachment
34 JW:djh

PROCEDURE MEMORANDUM
PIPE MATERIAL SELECTION GUIDELINES

General

Effective December 15, 2006 the final rule on pipe selection was published. This rule amends the material selection policies to support competitive bidding. Rule 23 CFR 635.411 (b) requires that all available non-proprietary pipe products that are judged to be of satisfactory quality and equally acceptable on the basis of engineering properties and economic analysis be considered. When products appear to be equal, alternative or optional bidding practices are required.

The rule further states that, where alternative products are determined to have different engineering and economic properties, based on the required engineering properties and/or life cycle cost criteria the State DOT should document its material selection decision on a project or program basis as appropriate. This document does not constitute a change to our current guidelines but emphasizes the need for proper analysis and documentation of material selection. This will continue to encourage competitive bidding while resulting in well engineered cost-effective installations.

It is MDT's practice to specify alternate or optional pipe materials where they can be used. To qualify for selection, optional pipe materials must meet the following criteria:

- Provide adequate hydraulic capacity
- Withstand forces of the weight of the fill over the pipe.
- Withstand forces of traffic loads and construction equipment during pipe installation and under post construction conditions.
- Withstand hydrostatic pressure to prevent fluid from leaking out of the pipe into the surrounding bed materials.
- Provide adequate service life in relation to the Culvert Service Life Guidelines.
- Withstand corrosion caused by the fluids conveyed by the pipe and the soil surrounding the pipe.
- Withstand abrasion from solids carried by the flow.
- Withstand fire and combustion.
- Be constructible within the constraints of the site.
- Provide desired fish passage characteristics and meet other project based environmental requirements.
- Consider local government preferences
- Fulfill the need for experimental installations and/or Materials Bureau product review process.

Culverts, storm drains, or other installations shall be studied on a case by case basis to determine if the optional materials satisfy these requirements.

Pipe Materials

Currently the Department is utilizing the following pipe materials as appropriate for mainline culvert crossings, approach culverts, irrigation facilities, and storm drains. For guidelines on the selection and use of optional pipe materials for specific applications see Table 2. The list of factors to be considered is not intended to be all inclusive, therefore a proper engineering analysis is required for all installations. For large installations, the analysis should include installation cost comparisons.

Table 1 – Pipe Materials

Material	Abbreviation	AASHTO Specification	MDT Specification
Corrugated Steel Pipe*	CSP	AASHTO M 36	709.02
Corrugated Steel Pipe Arch*	CSPA	AASHTO M 36	709.02
Structural Steel Plate Pipe**	SSPP	AASHTO M 167	709.03
Structural Steel Plate Pipe Arch**	SSPPA	AASHTO M 167	709.03
Reinforced Concrete Pipe	RCP	AASHTO M 170	708.01.2
Reinforced Concrete Pipe Arch	RCPA	AASHTO M 206	708.01.3
Reinforced Concrete Box	RCB	AASHTO M 259 AASHTO M 273	-
Corrugated Aluminum Pipe	CAP	AASHTO M 196	709.07
Corrugated Polyethylene Pipe	HDPE	AASHTO M 294	708.07
* Acceptable coatings :	- Type II Aluminized - Pre-Coated Polymeric - Bituminous	AASHTO M 274 AASHTO M 245 AASHTO M 243	709.12 709.05 709.04
** Acceptable coatings:	- Bituminous	AASHTO M 243	709.04

New Materials

Pipe materials that the Department does not have a history with in drainage applications are generally not listed on Tables 1 and 2. However, the Department is willing to review new products to determine if the product could be suitable for highway use in the future.

Specifications for new pipe materials may be submitted to the Department's Standards Committee for review. The Standards Committee is administered by the Materials Bureau. Experts from various sections within the Department including Construction, Maintenance, Geotechnical, Hydraulics, Bridge, and Road Design may be asked to participate in product reviews.

Submitted products are reviewed for specification requirements, product history, previous usages, constructability, and tested in the Department's materials laboratory. If a product or material is found to be acceptable it may be utilized on specific projects on an experimental basis. Currently the Department has an experimental project involving polyethylene pipe.

Public Interest Finding

Pursuant to 23 CFR 635.411, a letter of public interest finding is required for;

- Proprietary materials
- Single material selections (those without options) not shown Table 2

MDT will prepare all public interest findings and will retain approval authority for projects that are defined as non-full oversight in the most current FHWA/MDT/MTC Partnership Agreement.

FHWA will be included in the distribution for concurrence and recommendations on all public interest findings. FHWA will retain public interest finding approval authority for full oversight projects. The current definition for full oversight projects are those on the National Highway System that meet the following criteria:

- All projects on the non-Interstate NHS costing $3 million or more.
- All reconstruction projects on the Interstate system costing $1 million or more.
- Pavement preservation and rehabilitations projects on the Interstate system costing $3 million or more.

The purpose of the public interest finding is to clearly document the reasoning and justification for the selection (i.e. synchronization).

Plan Preparation

MDT will continue to utilize the "Optional Pipe Culvert Summary Frame" as included in the Road Design Manual per Fig 4.4 K-7 in order to specify proposed materials for reconstruction projects. When pipe extensions are required, the culvert summary frame shown in Fig 4.4 K-8 may be used.

Alternate culvert summary frames as shown in Fig 4.4 K-9 may be used when large diameter structures such as reinforced concrete boxes or structural steel pipes are to be considered as alternate bid items or when a specific material may require special treatment but should be included in the overall cost of the installation. Use of this frame should be discussed and agreed to at PIH.

Table 2
Guidelines for Optional Pipe Material Selection

Application	Factors to be Considered	Materials to be Considered
Mainline Drainage Design Service Life - 75 Years	- Service Life - Soil / Water Corrosivity - Fill Height - Bed Load Abrasion - Active Channel Width - Fish Passage	- Corrugated Steel Pipe and Arches (CSP / CSPA) - Structural Steel Plate Pipe and Pipe Arches (SSPP / SSPPA) - Corrugated Aluminum Pipe (CAP) - Reinforced Concrete Pipe (RCP) - Reinforced Concrete Box (RCB)
Approach Drainage Design Service Life - 40 Years	- Service Life - Soil / Water Corrosivity - Fill Height - Bed Load Abrasion - Active Channel Width - Fish Passage	- Corrugated Steel Pipe and Arches (CSP / CSPA) - Structural Steel Plate Pipe and Pipe Arches (SSPP / SSPPA) - Corrugated Aluminum Pipe (CAP) - Corrugated Polyethylene Pipe (HDPE) - Reinforced Concrete Pipe (RCP) - Reinforced Concrete Box (RCB)
Pipe Extensions Remaining Service Life - 20 Years	- Review Remaining Pipe Service Life	- Match Existing Material
Inverted Siphons and Irrigation Facilities See Note 7.	- Service Life - Soil / Water Corrosivity - Water Tight Joints - Fill Height - Bed Load Abrasion - Channel Width - Maintenance Practices	- Irrigation Class Reinforced Concrete Pipe (RCP) - Reinforced Concrete Box (RCB)
Active Stream Crossings and Large Irrigation Canals See Note 7.	- Service Life - Soil / Water Corrosivity - Water Tight Joints - Fill Height - Bed Load Abrasion - Channel Width	- Corrugated Steel Pipe and Arches (CSP / CSPA) - Structural Steel Plate Pipe and Pipe Arches (SSPP / SSPPA) - Reinforced Concrete Pipe (RCP) - Reinforced Concrete Box (RCB)
Stormdrain Trunkline and Laterals Design Service Life - 75 Years	- Service Life - Soil / Water Corrosivity - Water Tight Joints - Hydraulic Capacity - Abrasion - Maintenance Responsibility (Owner Preference) - ADT - Surfacing Type	- Irrigation Class Reinforced Concrete Pipe (RCP) - Reinforced Concrete Box (RCB)

Notes

1. The materials listed for each application in this table are a preliminary estimate of possible optional materials. **Not all of the materials may be feasible in all situations and additional engineering criteria may require evaluation.**
2. Some materials may not have adequate hydraulic capacity, service life, corrosion and abrasion resistance, structural capacity, resistance to fire damage, or they may not satisfy environmental requirements or the preferences of local jurisdictions.
3. The use of a specific pipe product may be used if documented properly in the Hydraulic Report in accordance with these guidelines, and the Culvert Service Life Guidelines. To fully document the optional pipe material selection, the following items should be included in the hydraulic report as appropriate.
   a. An individual hydraulic analysis for each culvert, storm drain, irrigation line or siphon. Additional analysis may be required for pipes with increased roughness values.
   b. Results from the corrosive soil and water testing that determine the applicable pipe materials, gages, and coatings that provide an adequate service life for the application.
   c. Verification that the minimum and maximum fill height for each optional pipe material and shape is applicable to each crossing.
   d. A determination if abrasion protection is required based on the channel bed material and estimated flow velocity.
   e. Documentation of any special site or environmental requirements such as fish passage, wildlife access, stream bank width restrictions, or floodplain or overtopping risk.
   f. Life-cycle cost analysis
4. The Culvert Service Life Guidelines located in Chapter 9; Appendix E of the adopted AASHTO Model Drainage Manual will be utilized to the extent possible and in combination with 23 CFR 635.411 (b) when specifying pipe products on MDT projects.
5. The fill height tables for various pipes are located in Chapter 17 of the Road Design Manual. These tables shall be used to determine the applicability of the various optional pipe materials, shape, gage, and wall thickness.
6. If maintenance practices such as ditch burning are anticipated near exposed pipe, plastic or coated metal pipe should not be used.
7. The life of irrigation or active stream structures is the time it takes for the first perforation to occur. The AISI chart determines total life, and time to first perforation is estimated to be one-half the total life. Therefore, the life determined by use of the AISI chart (or the equations) must be divided by two to determine time to first perforation.