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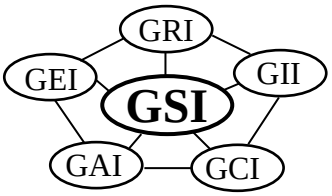

GSI White Paper #39

"Current Status (2018) of U.S. State Department of Transportation Agencies Regarding Use of Geosynthetic Materials"

by

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Current Status (2018) of U.S. Department of Transportation Agencies
Regarding Selected Use of Geosynthetic Materials
by
Jamie R. Koerner, Robert M. Koerner and George R. Koerner

Background

By virtue of federal U.S. regulations on solid waste landfill liners and covers, every state environmental agency has regulations which include geosynthetic materials to varying degrees. As such, the Geosynthetic Institute has performed surveys of these fifty state agencies and reported the information accordingly; the most recent being White Paper #37, dated March 9, 2018. This, in turn, prompted many requests to do likewise with the fifty U.S. State Departments of Transportation (DOT) agencies. One fundamental difference at the outset is that the federal U.S. government has no transportation related regulations requiring the use of geosynthetic materials, or any other materials for that matter. As a result, each state DOT acts individually and without federal regulation, although there is undoubtedly federal guidance and assistance. In this regard, various federal conferences and workshops bring together state highway and related personnel on a regular basis. In addition, the U.S. Federal Highway Administration (FHWA) is extremely active at national, regional and state levels in describing and presenting new materials and fields of application as research and development occurs.

With the above described difference between environmental and transportation public agencies, we nevertheless proceeded in sending out a survey regarding geosynthetic usage to the fifty state DOT agencies. But specifically to whom? Within state DOT agencies, there are bridge departments, right-of-way departments, materials departments, geotechnical departments, etc. Thus identifying a specific individual, or individuals, required considerable searching. As a result, we received 22 state DOT responses (i.e. 44% return) insofar as the results are concerned. We sincerely thank each of these DOT agencies for responding and have sent a copy of this white paper to them accordingly. The survey questionnaire (subdivided into six discrete application areas) as it was sent to all state DOTs follows:

Geosynthetic Institute Survey
"State DOT Regulations and Use of Geosynthetics"
March 15, 2018

Q1 – Regarding geosynthetic reinforced earth walls (facing angle ≥ 70° to the horizontal)

(a) Does your state permit them? yes ☐ no ☐ silent ☐

(b) Are they limited in their height? yes ☐ limit ____ no ☐

(c) Do you use back drainage behind the reinforced zone? yes ☐ no ☐ silent ☐

(d) Design-wise do you use FHWA/NCHRP procedures? yes ☐ no ☐ silent ☐

(e) Do you allow vendor-design? yes ☐ no ☐ silent ☐

(f) Do you require certified inspectors? yes ☐ no ☐ silent ☐

(g) What type of facing is preferred? concrete panels ☐ masonry blocks ☐ vegetated ☐ other ☐

Comments_____
_____
_____

Q2 – Regarding geosynthetic reinforced earth slopes (facing angle < 70° to the horizontal)

(a) Does your state permit them? yes ☐ no ☐ silent ☐

(b) Are they limited in their height? yes ☐ limit ____ no ☐

(c) Do you use back drainage behind the reinforced zone? yes ☐ no ☐ silent ☐

(d) Design-wise do you use FHWA/NCHRP procedures? yes ☐ no ☐ silent ☐

(e) Do you allow vendor-design? yes ☐ no ☐ silent ☐

(f) Do you require certified inspectors? yes ☐ no ☐ silent ☐

Comments_____
_____
_____

Q3 – Regarding the AASHTO-M288 Geotextile Specification…

(a) Do you use it for drainage (i.e., filtration)? yes ☐ no ☐ other ☐

(b) Do you use it for roadway separation? yes ☐ no ☐ other ☐

(c) Do you use it for roadway stabilization? yes ☐ no ☐ other ☐

(d) Do you use it for erosion control? yes ☐ no ☐ other ☐

(e) Do you use it for silt fences? yes ☐ no ☐ other ☐

(f) Do you use it for asphalt overlay fabrics? yes ☐ no ☐ other ☐

(g) Do you feel the need for a comparable generic specification for geogrids?
yes ☐ no ☐ maybe ☐

Commets_____
_____

Q4 – Regarding prefabricated geocomposite highway edge drains…

(a) Do you use these products? yes ☐ no ☐ silent ☐

(b) If yes, do you have a specification? yes ☐ no ☐ silent ☐

Comments_____
_____

Q5 – Regarding geosynthetic erosion control products (e.g., turf reinforcement mats)

(a) Do you use these products? yes ☐ no ☐ silent ☐

(b) Do you have a specification? yes ☐ no ☐ silent ☐

(c) Do you work from an approved bidders list? yes ☐ no ☐ silent ☐

Comments_____
_____

Q6 – Regarding geomembranes for waterproofing ponds and lagoons…

(a) Do you have specifications? yes ☐ no ☐ silent ☐

(b) Is there a minimum lifetime? yes ☐ no ☐ silent ☐

(c) Are their installation guidelines? yes ☐ no ☐ silent ☐

Comments_____
_____

Name_____ email_____

Thank you very much for responding and we will send the completed results as soon as possible. Please contact Jamie Koerner at jrkoerner@verizon.net for comments or questions.

Survey Answers

The summary of the 22 state DOT responses to this survey is given as the appendix to this white paper. Please see it for details of each specific state's responses. That said, each of the underlined six application areas will be described in a summary fashion as follows.

Application Area #1 – Geosynthetic Reinforced Earth Walls

Mechanically stabilized earth (MSE) walls were initially developed (and patented) in the mid 1960's by Henri Vidal in France using steel strips attached to steel facing elements and extending back into the reinforced soil to a designated distance. By the 1970's, the U.S. Forest Service was using geotextile reinforcement and subsequently in the 1980's, product manufacturers began using geogrid reinforcement. This type of geosynthetic reinforced MSE walls is the target area of this set of questions. Incidentally, the FHWA uses the criterion of the angle that the wall facing makes with the horizontal to distinguish walls from slopes. If the angle is 70º or larger, it is an MSE wall, if less than 70º it is a reinforced soil slope (RSS).

To the question of "does the state permit them" to be used, 20 of 22 (91%) states answered yes. Note that this is not a permitting process, per se, it is allowing their use when professionally designed by others such as a registered professional engineer in their state. Furthermore, there are wall height limits required by 9 of these 20 states. The values range considerably, from 15 to 40 feet. For 13 states, there is no such limitation. While front drainage using gravel directly behind the wall facing is required by all MSE wall designs, back drainage behind the reinforced soil zone is a separate issue and was specifically questioned. Twelve of the 22 states (56%) require back drainage to be included, other responses were mixed. In light of the many FHWA design documents and courses having been given on the topic, we were interested if the states use such design procedures. Nineteen of the 22 states (86%) said yes, while the others were silent in this regard. Alternatively, some MSE walls with geosynthetic reinforcement are designed by "vendors" which are often geogrid manufacturers. Thirteen states of the 22 allowed for such vendor design. Regarding the actual construction operations, only 4 states require "certified inspectors", although such a program is available at….
(see www.geosynthetic-institute.org/icpintro2.htm)
Lastly, the type of preferred wall facing was asked. Concrete panels and masonry blocks were by far the most used type of facing.

Application Area #2 – Reinforced Soil Slopes

Reinforced soil slopes (RSSs) refer to soil structures having facing angles lower than a 70º angle with the horizontal. Survey questions were similar to those of the MSE walls, but the responses were somewhat different. The reason for this is conjecture, but may be due to the lessened perceived concerns over a slope problem occurring, as compared to a wall problem. Whatever the case, all 22 states allow for RSS structures with geosynthetic reinforcement. Even further, 20 of them have no height limits; the other 2 states differ greatly, one with a maximum height of 15 feet, the other at 50 feet. Back drainage behind the reinforced soil zone is required in 11 states which mirrors the answer for MSE walls. FHWA procedures are required for design in 18 states and vendor design is allowed by 4 states. Certified inspectors for field construction are only required by 4 states.

Application Area #3 – Geotextile Specifications

In the U.S., the 50 state DOTs meet and interact regularly through an organization called the American Association of State Highway and Transportation Officials (AASHTO). In 1984 they convened a group called Task Force #25 which began to develope a generic specification for geotextiles used in highway related applications. Eventually, in 1993, the effort morphed into AASHTO-M288 "Geotextile Specification for Highway Applications". Modifications and additions were made in 1996, 1999, 2005 and 2016; the latter being a very complete and detailed 35 page document. In M288-16, a survivability table is presented providing geotextile strength properties in three different classes. This is followed by a series of six independent tables on each particular application. They are as follows; drainage (actually filtration), separation, stabilization, erosion control, silt fences and paving fabrics. The results of the survey insofar as the use of this specification for each of these applications are as follows:

- use in drainage (filtration): 15 of 22 (68%)
- use in separation: 14 of 22 (63%)
- use in stabilization 13 of 22 (59%)
- use in erosion control 11 of 22 (50%)
- use in silt fences 11 of 22 (50%)
- use in paving fabrics 4 of 22 (18%)

One last question was asked with respect to the use of AASHTO-M288-16 for a geogrid specification. In this regard, the 2016 specification presented a draft bidirectional geogrid specification. We were interested in the state's need for such a generic specification and 12 of 22 (54%) agreed, with 5 more as "maybe" response. The other five states were not interested.

Application Area #4 - Prefabricated Highway Edge Drains

There are a number of manufactured highway edge drains consisting of a polymer drainage core surrounded by a geotextile acting as a filter and as a separator. These products arrive at a job site in the form of large rolls, either 6, 12, or 18 inches in height, and then are installed directly against the edge of highway pavements for capture and release of subsurface drainage of the gravel base course and/or subbase. In response to our questions, 13 of 22 states (59%) use these products and 10 of the 13 states (77%) have an associated product specification.

Application Area #5 – Erosion Control Products

Soil erosion touches on every aspect of our activities including highway applications. The geosynthetic industry (among others) has developed many products toward the avoidance, or mitigation of soil erosion; see GSI White Paper #38 at…
(www.geosyntheticinstitute.org/papers/paper38.htm) for details in this regard. Even further, GSI has a generic specification for one category of products, namely "turf reinforcement mats" see…
(www.geosynthetic-institute.org/grispecs/gc14.pdf)
Our questions to the state agencies and answers were as follows:

• Are these products used?	20 of 22 (91%) said yes
• Is there a specification?	17 of 22 (77%) said yes
• Is there an approved bidder's list?	11 of 22 (50%) said yes

Application Area #6 – Waterproofing Ponds and Lagoons

We have recently been informed that several state DOT agencies were being asked to review and/or improve liners for waterproofing ponds and lagoons. With geomembranes being the main barrier material to limit leakage and migration of the liquid contents, we wondered how widespread this activity was. Three questions were asked and answered accordingly:

• Does the state have a specification?	6 of 22 (27%) said yes
• Is there a minimum lifetime?	1 of 22 (5%) said yes
• Are there installation guidelines?	2 of 22 (9%) said yes

Appendix

Geosynthetic Institute Survey of State DOT Regulations and Use of Geosynthetics - 2018

1. Geosynthetic Reinforced Earth Walls > 70°		AL	AZ	CA	DE	FL	IA	LA	MD	MT	MS	NJ	NY	OH	OR	SD	TN	UT	VT	VA	WA	WV	WI	TOTAL	Percent
a) does state permit them	yes	x	x	x	x	x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	**20**	**91%**
	no																							**0**	
	silent						x							x										**2**	**9%**
b) Are there height limits	yes	x	x			x									x	x	x			x		x	x	**9**	**41%**
	limit	15'				40'										15'						40'	22-35'	**15-40'**	
	no			x	x		x	x	x	x	x	x	x	x				x	x		x			**13**	**59%**
c) Is back drainage used behind reinforced zone																									
	yes	x	x	x	x	x				x			x		x			x	x		x	x		**12**	**56%**
	no						x	x								x	x						x	**5**	**22%**
	silent								x		x	x		x						x				**5**	**22%**
d) Design- do you use FHWA/NCHRP procedures																									
	yes	x	x	x	x	x		x	x	x		x	x		x	x	x	x	x	x	x	x	x	**19**	**86%**
	no																							**0**	
	silent						x				x			x										**3**	**14%**
e) Do you allow vendor design	yes		x		x				x	x			x		x	x	x		x	x	x	x	x	**13**	**59%**
	no	x				x	x					x												**4**	**18%**
	silent			x				x			x			x				x						**5**	**23%**
f) Do you require Certified Inspectors	yes	x											x		x					x				**4**	**18%**
	no		x	x	x	x	x	x	x	x	x	x				x	x	x	x		x	x	x	**17**	**77%**
	silent													x										**1**	**5%**

g) What type of facing is preferred	AL	AZ	CA	DE	FL	IA	LA	MD	MT	MS	NJ	NY	OH	OR	SD	TN	UT	VT	VA	WA	WV	WI	TOTAL	Percent
concrete panels		x	x	x	x			x			x					x		x	x		x	x	**11**	**28%**
masonry blocks		x		x			x	x		x	x				x	x	x	x	x		x	x	**13**	**33%**
vegetated																							**0**	
No preference	x					x			x			x	x	x						x			**7**	**17%**
Both Concrete and Masonry																							**9**	**22%**

2.Geosynthetic Reinforced Earth Slopes <70º

a) Does your state permit them		AL	AZ	CA	DE	FL	IA	LA	MD	MT	MS	NJ	NY	OH	OR	SD	TN	UT	VT	VA	WA	WV	WI	TOTAL	Percent
	yes	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	**22**	**100%**
	no																								
	silent																								

b) Are they limited in their height		AL	AZ	CA	DE	FL	IA	LA	MD	MT	MS	NJ	NY	OH	OR	SD	TN	UT	VT	VA	WA	WV	WI	TOTAL	Percent
	yes	x																				x		**2**	**9%**
	limit	15'																				50'		**15-50'**	
	no		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	**20**	**91%**

c) Is back drainage used behind reinforced zone		AL	AZ	CA	DE	FL	IA	LA	MD	MT	MS	NJ	NY	OH	OR	SD	TN	UT	VT	VA	WA	WV	WI	TOTAL	Percent
	yes	x	x	x	x				x				x		x			x	x		x	x		**11**	**50%**
	no					x	x	x		x	x			x		x	x						x	**9**	**41%**
	silent											x								x				**2**	**9%**

d) Design- do you use FHWA/NCHRP procedures		AL	AZ	CA	DE	FL	IA	LA	MD	MT	MS	NJ	NY	OH	OR	SD	TN	UT	VT	VA	WA	WV	WI	TOTAL	Percent
	yes	x	x	x	x	x			x	x		x	x	x	x	x		x	x	x	x	x	x	**18**	**82%**
	no							x																**1**	**5%**
	silent						x				x						x							**3**	**13%**

e) Do you allow vendor design		AL	AZ	CA	DE	FL	IA	LA	MD	MT	MS	NJ	NY	OH	OR	SD	TN	UT	VT	VA	WA	WV	WI	TOTAL	Percent
	yes				x				x									x				x		**4**	**18%**
	no	x	x			x	x	x		x		x	x			x	x		x	x	x		x	**14**	**64%**
	silent			x							x			x	x									**4**	**18%**

		AL	AZ	CA	DE	FL	IA	LA	MD	MT	MS	NJ	NY	OH	OR	SD	TN	UT	VT	VA	WA	WV	WI	TOTAL	Percent
f) Do you require Certified Inspectors	yes	x											x		x					x				**4**	**18%**
	no		x	x	x	x		x		x	x	x		x		x	x	x	x		x	x	x	**17**	**77%**
	silent								x															**1**	**5%**

3. AASHTO-M288 Geotextile Specification

a) Do you use it for drainage	yes	x		x	x				x	x	x	x		x	x	x	x	x	x	x		x		**15**	**68%**
	no		x				x																x	**3**	**14%**
	other					x		x					x								x			**4**	**18%**
b) Is it used for roadway separation	yes	x			x			x	x	x	x	x		x	x	x	x	x	x			x		**14**	**63%**
	no		x				x																x	**3**	**14%**
	other			x		x							x							x	x			**5**	**23%**
c) Is it used for roadway stabilization	yes	x		x	x				x	x	x	x			x	x	x	x	x			x		**13**	**59%**
	no		x				x							x						x			x	**5**	**23%**
	other					x		x					x								x			**4**	**18%**
d) Is it used for erosion control	yes	x		x	x				x	x	x	x			x		x	x	x					**11**	**50%**
	no		x				x													x		x	x	**5**	**23%**
	other					x		x					x	?		x					x			**6**	**27%**
e) Is it used for silt fences	yes	x			x				x	x	x	x			x		x	x		x		x		**11**	**50%**
	no		x				x									x							x	**4**	**18%**
	other			x		x		x					x	?					?		x			**7**	**32%**

		AL	AZ	CA	DE	FL	IA	LA	MD	MT	MS	NJ	NY	OH	OR	SD	TN	UT	VT	VA	WA	WV	WI	TOTAL	Percent
f) Is it used for asphalt overlay fabrics	yes	x						x							x		x							**4**	**18%**

no		x		x	x	x		x	x	x	x				x		x	x	x	x	x	x	**15**	**68%**
other			x									?	?										**3**	**14%**

g) Do you feel need for generic spec for geogrids

yes		x		x	x			x	x		x	x	x	x		x			x		x		**12**	**54%**
no	x		x												x			x				x	**5**	**23%**
maybe						x	x			x							x			x			**5**	**23%**

4. Prefabricated geocomposite HW edge drains

a) Do you use these products	yes	x	x	x			x			x			x	x	x			x		x	x	x	x	**13**	**59%**
	no				x	x			x			x				x	x		x					**7**	**32%**
	silent							x			x													**2**	**9%**

b) If yes, do you have a specification	yes	x	x	x			x			x				x	x					x	x	x		**10**	**66%**
	no												x					x					x	**3**	**20%**
	silent							x			x													**2**	**14%**

5. Geosynthetic Erosion Control Products

a) Do you use these products	yes	x	x		x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	**20**	**91%**
	no			x								x												**2**	**9%**
	silent																							**0**	

b) Do you have a specification	yes	x			x	x	x	x	x	x	x		x	x	x	x	x	x	x	x			x	**17**	**77%**
	no		x	x								x										x		**4**	**18%**
	silent																				x			**1**	**5%**

c) Do you work from an approved bidder list	yes	x				x	x	x	x		x		x	x	x		x						x	**11**	**50%**
	no		x		x											x		x	x	x	x	x		**8**	**36%**
	silent			x						?		x												**3**	**14%**

6. G**eomembranes for waterproofing ponds/lagoons**

AL	**AZ**	**CA**	**DE**	**FL**	**IA**	**LA**	**MD**	**MT**	**MS**	**NJ**	**NY**	**OH**	**OR**	**SD**	**TN**	**UT**	**VT**	**VA**	**WA**	**WV**	**WI**	**TOTAL**	**Percent**

a) Do you have a specification	yes		x	x					x	x			x							x				**6**	**27%**
	no				x		x	x			x	x		x	x		x	x	x		x	x	x	**13**	**59%**
	silent	x				x										x									**3**	**14%**
b) Is there a minimum lifetime	yes								x																**1**	**5%**
	no		x	x	x		x	x					x	x	x			x	x	x	x	x	x	**14**	**63%**
	silent	x				x				x	x	x				x	x								**7**	**32%**
c) Are there installation guidelines	yes		x						x																**2**	**9%**
	no				x		x	x				x	x	x	x			x	x		x	x	x	**12**	**55%**
	silent	x		x		x				x	x					x	x			x					**8**	**36%**