Prepared for ADOT by NCS Consultants, LLC (NCS)
This is a partial checklist. Some pages have been intentionally deleted as this copy is intended to demonstrate the capabilities of NCS. For a full checklist please contact NCS or ADOT.

MSE WALLS - DESIGN REVIEW
ADOT CHECKLIST - Version 1.0

TO BE FILLED BY RESIDENT ENGINEER

Project (Name, Contract No., TRACS No.)	
Resident Engineer (RE)	
Date MSE submittal received	
Is this a re-submittal? If yes, attach previous checklist	
Name of Geotechnical Engineer of Record (GER)	
Date submittal transmitted to GER	
Date comments due back to RE	

TO BE FILLED BY GER	**REVIEWED BY**				
	Materials Group Due Date**	**Date Received**	**Date Reviewed**	**Name**	**Organization**
Professional (Geotechnical) Engineer of Record*(GER)					
Date completed checklist sent to RE					

***** **Contact designated ADOT Geotechnical Design Engineer (ADOT GDE) immediately upon receipt of the submittal(s) from RE.**

****** **Due date for submittal to ADOT GDE. To be decided at the time GER receives submittal from RE and contacts ADOT GDE.**

This checklist has been completed under the supervision of the Professional Engineer of Record whose seal and signature appears hereon.	

LEGEND FOR ABBREVIATIONS / ACRONYMS

ADOT	Arizona Department of Transportation
ADOT GDE	Geotechnical Design Engineer from ADOT's Materials Group assigned to the project.
APL	Approved Products List (For latest APL visit http://www.dot.state.az.us/about/atrc/pride/apl.htm). Note APL is updated monthly.
FHWA	Federal Highway Administration
GER	Geotechnical Engineer of Record (shall be a Registered Professional Engineer in Arizona)
MBW	Modular Block Wall
MSE	Mechanically Stabilized Earth
MSEW 2.0	Version 2.0 of proprietary software, MSEW, by ADAMA Engineering (visit www.geoprograms.com)
NA	Not Applicable
NHI	National Highway Institute
PE	Professional Engineer of Record (shall be a Registered Professional Engineer in Arizona)
PGR	Project Geotechnical Report
Project Drawings	Complete final plan set for the project
RE	Resident Engineer
Section #, Figure # or Table #	This refers to an appropriate section, figure or table in the following manual by FHWA/NHI: "Mechanically Stabilized Earth Walls and Reinforced Soil Slopes," Publication No. FHWA NHI-00-043, March 2001 (Authors: Victor Elias, Barry R. Christopher and Ryan R. Berg)
Spec	Project specification including standard specification and special provisions
Vendor Drawings	Working drawings provided by MSE wall vendor

All symbols used within the questions are consistent with those used in the documents in the "Reference" column

NOTES FOR CHECKLIST

1. The following information/material should be collected before starting the checklist:
   a. Contractor submittals (transmittal letter, design drawings, design calculations)
   b. Project documents (final plan set, standard specifications, special provisions, Project Geotechnical Report)
   c. FHWA/NHI manual ("Mechanically Stabilized Earth Walls and Reinforced Soil Slopes," Publication No. FHWA NHI-00-043, March 2001; Authors: Victor Elias, Barry R. Christopher and Ryan R. Berg)
   d. Latest version of AASHTO including interims
   e. All due dates for checklist
   f. Name of the structural engineer
   g. Name of the roadway engineer
   h. Name of "prime" designer
2. Each question must have a "Yes", "No" or "NA" box checked. Any comment or action required should be entered in the "Comments/Action Required" column. If the "No" or "NA" box is checked then an appropriate comment or action required must be entered. Use separate sheets if comments cannot be fitted in the space within the checklist.
3. The documents listed under the "Reference" column in the checklist are not intended to be a complete list of documents. Rather, the most common documents are listed where guidance/information related to the question in the checklist may be found. More stringent criteria may exist in other project documents (e.g., drainage, signage, utilities, etc.) that may be relevant to a given question. In such an event, the governing document should be noted in the "Comments/Action Required" column of the checklist.
4. Add any pertinent project specific questions to the checklist as necessary. Two empty rows are provided at end of each section for this purpose. Use additional sheets as necessary if more space is required.
5. This checklist is intended to be completed, signed and sealed by the Geotechnical Engineer of Record who is Registered Professional Engineer in the State of Arizona.
6. The Geotechnical Engineer of Record should contact the project structural or roadway engineer in case of discrepancies between the contractor submittals and reference documents.
7. Wall details that were reviewed and approved as part of the "Approved Products List" will be available on a website; contact the Materials Group for further information.
8. After completing the checklist the GER should include an attachment that identifies specific questions that the MSE wall vendor has to address.

		Reference (See Note 3)	Yes	No	NA	Comments/Action Required
I.	**GENERAL INFORMATION**					
1.	Is the wall vendor pre-approved? (visit http://www.dot.state.az.us/about/atrc/pride/apl.htm for a list of pre-approved wall systems)	APL	☐	☐	☐	
2.	Is the wall within the limitations of the pre-approved product? (e.g., wall height, external loading, environmental constraints, seismic loading and other project specific constraints; visit http://www.dot.state.az.us/about/atrc/pride/apl.htm for limitations)	APL	☐	☐	☐	
3.	Has the Contractor used the correct design survey data (e.g., existing ground elevations and horizontal offsets) for wall design?	Project/vendor drawings	☐	☐	☐	
4.	Has the Contractor correctly reflected the location of utilities in the area of the wall(s)?	Project/vendor Drawings	☐	☐	☐	
5.	Is the wall profile (top and bottom elevations) including start and end stations correct?	Project/vendor Drawings	☐	☐	☐	
6.	Is the wall design life specified?	Spec/Section 2.7	☐	☐	☐	
7.	Have the following items been specified by the vendor and are they in conformance with the project requirements?					
	a. Material requirements					
	i. Soil Properties (strength, gradation, PI, soundness, electrochemical)	Spec	☐	☐	☐	
	ii. Soil Reinforcement (ultimate, yield, allowable strengths, reduction factors for geosynthetics)	Spec	☐	☐	☐	
	iii. Concrete (strength and other properties)	Spec/Project Drawings	☐	☐	☐	
	iv. Concrete reinforcement (type, number and strength)	Spec/Project Drawings	☐	☐	☐	
	v. Leveling Pad (strength)	Spec/Project Drawings	☐	☐	☐	
	vi. Steel facing elements for wire mesh systems (yield and allowable strengths)	Spec	☐	☐	☐	
	b. Construction procedures including sequence	APL	☐	☐	☐	
	c. Soil compaction procedures and restrictions for reinforced fill, retained fill and foundation preparation	APL/spec/PGR	☐	☐	☐	

		Reference (See Note 3)	Yes	No	NA	Comments/Action Required
			☐	☐	☐	
			☐	☐	☐	
IV.	**FACING UNITS AND JOINTS**					
1.	Are the facing units from the pre-approved list?	APL	☐	☐	☐	
2.	Do facing units meet the project aesthetic criteria?	Spec/Project Drawings	☐	☐	☐	
3.	Have the material properties of the facing units been specified? (Examples: density, strength, freeze-thaw, etc.)	Section 4.4/Spec	☐	☐	☐	
4.	Are the materials properties of the facing units in conformance with the project criteria? (Examples: density, strength, freeze-thaw, etc.)	Section 4.4/Spec				
5.	Are the facing units structurally adequate as per the project facing units structural criteria and/or per AASHTO? (deformation of facing elements including local bending should be within allowable limits)	Section 4.4/Spec	☐	☐	☐	
6.	Is the horizontal joint width between facing units consistent with estimated differential settlements?	Section 2.7, Table 3	☐	☐	☐	
7.	Does the joint bearing pad material conform to project specifications?	Spec	☐	☐	☐	
8.	Is the joint bearing pad material of proper compressive strength such that facing unit to facing unit crushing and /or high stress concentrations on any facing units are prevented?	Spec/APL	☐	☐	☐	
9.	For Modular Block Wall (MBW) units with geosynthetic soil reinforcement has the hinge height concept been used for establishing connection details?	Section 4.3	☐	☐	☐	
			☐	☐	☐	
			☐	☐	☐	
V.	**DRAINAGE**					
1.	Are all vertical and horizontal joints covered with geotextile fabric on the backside of the wall facing units?	Spec	☐	☐	☐	
2.	Is the geotextile fabric covering the joints of sufficient width and continuous across the joints?	Spec	☐	☐	☐	
3.	Do the geotextile fabric properties (survivability, filtration and permittivity) covering the joints meet project specifications?	Spec	☐	☐	☐	
4.	Has drainage along the backcut been included as per project criteria?	PGR/Spec	☐	☐	☐	

		Reference (See Note 3)	Yes	No	NA	Comments/Action Required
	reinforcements around vertical obstructions within the MSE backfill? (examples of vertical obstructions include piles, shafts, inlet structures, etc.)	Section 4.5				
4.	Are the structural frames designed properly so that moments and torques are not introduced in the bar mat soil reinforcements and/or the reinforcement/facing unit connection?	APL/Bridge Group	☐	☐	☐	
5.	Is the splay of strip reinforcements limited to less than 5 degrees?	Spec	☐	☐	☐	
6.	If strip reinforcements are splayed, then is the length increased to compensate for reduction in effective length?	PGR/Spec	☐	☐	☐	
7.	Is the maximum vertical bend (maximum 15 degrees) in metallic soil reinforcements within acceptable limits?	Spec/Section 4.5	☐	☐	☐	
8.	Are geosynthetic reinforcement details around vertical obstructions acceptable?	APL	☐	☐	☐	
9.	Are overlapping reinforcements separated vertically by at least 3-inches of soil?	Spec	☐	☐	☐	
10.	If walls are tiered, then are they in accordance with project criteria?, e.g., bench widths, aesthetics within benches, etc.	Spec/Section 5.2	☐	☐	☐	
11.	If instrumentation is required per project specs, then is it provided? (List the instrumentation in the comments column)	PGR/Spec	☐	☐	☐	
12.	Are corrosion/durability protection details acceptable?	Spec/Section 3.5	☐	☐	☐	
			☐	☐	☐	
			☐	☐	☐	
VII.	**SOIL REINFORCEMENT**					
1.	Is the soil reinforcement type (extensible or inextensible) and configuration (strip, grid or sheet) in conformance with pre-approved list?	APL	☐	☐	☐	
2.	Are the following soil reinforcement dimensions in conformance with those approved by ADOT during the pre-approval process?	APL				
	a. strip thickness or bar diameter	APL	☐	☐	☐	
	b. strip width or bar mat width	APL	☐	☐	☐	
	c. center to center spacing of the longitudinal bars in bar mats	APL	☐	☐	☐	
	d. center to center spacing of the transverse bars in bar mats	APL	☐	☐	☐	
	e. Geosynthetic grid (uniaxial/biaxial) openings and junction sizes	APL	☐	☐	☐	
3.	Is the connection of the soil reinforcement to the facing units as per the pre-approved connection detail?	APL	☐	☐	☐	
4.	Is the soil reinforcement specified to have the correct type and thickness of the	Spec/Section 3.5	☐	☐	☐	

		Reference (See Note 3)	Yes	No	NA	Comments/Action Required
	bearing pressure at all locations along the wall?					
7.	Is the wall embedment equal to or greater than the project requirements?	PGR	☐	☐	☐	
8.	Has total settlement analysis been performed?	PGR	☐	☐	☐	
9.	Has differential settlement analysis been performed?	PGR	☐	☐	☐	
10.	Have slip joints been provided to prevent stresses due to large anticipated differential settlements?	PGR/APL/Section 2.7, 4.2	☐	☐	☐	
11.	Is an undercut needed due to soft or poor soils? If so, is the depth of treatment and the replacement material specified?	PGR/Spec	☐	☐	☐	
12.	Will deep foundations be needed for very deep layers of soft/loose soils?	PGR/Spec	☐	☐	☐	
13.	Will waiting period(s) and stage construction be needed if the design wall pressure exceeds the maximum allowable bearing pressure?	PGR/Spec	☐	☐	☐	
			☐	☐	☐	
			☐	☐	☐	
IX.	**INTERNAL STABILITY**					
1.	Have calculations for internal stability of the wall been performed?	PGR/Spec	☐	☐	☐	
2.	Has the static and seismic internal stability evaluation been performed by the "Simplified Coherent Gravity" method?	PGR/Spec/Section 4.3	☐	☐	☐	
3.	Have all the critical sections along all walls been analyzed? (e.g., highest wall sections, sections where slopes above and below the walls are steepest, etc.)	Project Drawings/PGR	☐	☐	☐	
4.	Are the safety factors against pullout adequate at each level of the reinforcement?	PGR/Spec/Section 4.3	☐	☐	☐	
5.	Is the correct value of allowable strength of steel used? (e.g., 0.55 F_y for strips and 0.48F_y for bar mats)	PGR/Spec/Section 3.5	☐	☐	☐	
6.	Are corrosion loss rates in conformance with project criteria?	PGR/Spec/Section 3.5	☐	☐	☐	
7.	Has the cross-sectional area for the soil reinforcement been corrected for corrosion losses over the design life of the structure?	PGR/Spec/Section 3.5	☐	☐	☐	
8.	Are the safety factors against tensile failure adequate at each level of reinforcement?	PGR/Spec/Section 4.3	☐	☐	☐	
9.	Are the connections designed for maximum tension in soil reinforcements?	Spec/Section 4.3	☐	☐	☐	
10.	Have the proper values of F* (including C_u, F_q, α_β, tanρ and variation with depth) been used?	Section 3.3, 4.3	☐	☐	☐	

		Reference (See Note 3)	Yes	No	NA	Comments/Action Required
11.	Is the correct value for the scale correction factor, α, been used?	Section 3.3, 4.3	☐	☐	☐	
12.	Is the correct value of unit perimeter, C, used?	Section 3.3, 4.3	☐	☐	☐	
13.	For geosynthetic reinforcement have the reduction factors for creep (RF_{CR}), durability (RF_D) and installation damage (RF_{ID}) been specified and are they acceptable?	Section 3.5/Spec	☐	☐	☐	
14.	For geosynthetic reinforcement is the overall safety factor for computation of allowable strength acceptable?	Section 3.5/Spec	☐	☐	☐	
15.	Has the correct stress ratio (K_r/K_a) been used for computing internal loads?	Section 4.3, Figure 29	☐	☐	☐	
16.	Has the correct internal failure surface been used for static and seismic cases?	Section 4.3	☐	☐	☐	
17.	Has the vertical stress been computed as per the requirements of the Simplified Coherent Gravity method?	Section 4.3				
18.	Are the definitions of the reinforcement configuration (grid openings, ratios of the bar diameters to spacing of bars in bar mats, etc.) consistent with pre-approved product list?	APL/Section 3.3	☐	☐	☐	
19.	Have all the external loads been incorporated into the wall analysis and design? (e.g., traffic impact loads, seismic loads, sloping surcharge, broken-back surcharges, etc.)	Section 4.3	☐	☐	☐	
20.	Have all the internal loads been incorporated into the wall analysis and design? (e.g., lateral loads from piles at abutments or overhead mast structures)	PGR/Spec/Section 4.3, 5.1	☐	☐	☐	
21.	Has the internal stability evaluation accounted for complex geometries such as tiered structures, acute corners, back-to-back walls, and obstructions?	PGR/Spec/Section 5.1 – 5.5	☐	☐	☐	
22.	Is the vendor's analysis acceptable to the Geotechnical Engineer of Record based on an independent verification using "Simplified Coherent Gravity" method and MSEW 2.0 or hand calculations? Please attach a copy of the verification calculations using the Simplified Coherent Gravity method.	GER/PGR	☐	☐	☐	
			☐	☐	☐	
			☐	☐	☐	
X.	**GLOBAL / COMPOUND STABILITY**					
1.	Has the owner's geotechnical engineer of record checked global stability?	PGR	☐	☐	☐	
2.	Has the vendor checked compound stability?	PGR/Spec/Section 4.2	☐	☐	☐	

		Reference (See Note 3)	Yes	No	NA	Comments/Action Required
3.	Has the vendor checked the global stability?	PGR/Spec	☐	☐	☐	
4.	Is the safety factor against global stability failure adequate?	PGR/Spec	☐	☐	☐	
5.	Is the safety factor against compound stability failure adequate?	PGR/Spec	☐	☐	☐	
6.	Are the geotechnical parameters for global and compound stability analyses appropriate and consistent with those used for other failure modes?	PGR/Spec	☐	☐	☐	
7.	Is ground improvement needed based on global stability analysis?	PGR	☐	☐	☐	
			☐	☐	☐	
			☐	☐	☐	
XI.	**FILE INFORMATION**					
1.	Has the Geotechnical Engineer of Record completed this checklist? If not, who?		☐	☐	☐	
2.	Has a representative from ADOT's Materials Group ensured that this checklist has been completed and outstanding issues identified?		☐	☐	☐	
			☐	☐	☐	
			☐	☐	☐	

LIST OF ATTACHMENTS BY GEOTECHNICAL ENGINEER OF RECORD

No.	Attachment	Comments/Action Required
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

As a minimum the GER should include an attachment that identifies the specific issues that need to be addressed by the MSE wall designer (vendor).