

# INDOT Subgrade Standard Specification & ITM Updates

Construction Conference, 2021

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# 2020 Updates

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- **Section 207 Subgrade Treatment**

- RSP 207-R-689

<https://www.in.gov/dot/div/contracts/standards/rsp/sep19/200/207-R-687%20200901.pdf>

- **Section 215 Chemical Modification of Soils**

- RSP 215-R-715

<https://www.in.gov/dot/div/contracts/standards/rsp/sep19/200/215-R-715%20200901.pdf>

- **Section 218 QC/QA Embankment and Subgrade (Newly Approved 2/18/21)**

- **Section 219 Cement Stabilized Subgrade Soil**

RSP 219-R-723

- **Indiana Test Method Revision**

<https://www.in.gov/indot/div/mt/itm/itm.htm>

# Subgrade Treatment

RSP 207-R-689

# 207.04 Subgrade Treatment Types

Type	Subgrade Description
I	24 in. of soil compacted in accordance with 203.23
IA	[blank]
IBC	14 in. chemical soil modification <i>using cement</i>
IBL	14 in. chemical soil modification <i>using lime</i>
IC	12 in. coarse aggregate No. 53 in accordance with 301
ID	12 in. coarse aggregate with Type 2B geotextile in accordance with 918.02(c)
II	6 in. coarse aggregate No. 53 in accordance with 301
IIA	<del>8 in. chemical soil modification</del>
III	In-place compaction in accordance with 203.23
IV	12 in. coarse aggregate No. 53 with Type IB geogrid in accordance with 214
IVA	12 in. coarse aggregate with Geocell confining system in accordance with 214
V	3 in. of subgrade excavated and replaced with 3 in. coarse aggregate No. 53

# Subgrade Selection Guidelines

Subgrade Type Recommendations-  
Used for Guidance Only

Road Description	Type of Work	Subgrade Length	MR Value at Optimum Moisture Content	Subgrade Type and Description	Remarks
SR/US/I	New Road, Road Reconstruction and > 8 ft Widening	> 800 ft	Maximum design MR 12500 psi (Max)	Type IBC * 14 in. cement soil modification	Cement only, perform MR test on molded specimens
SR/US/I	New Road, Road Reconstruction and > 8 ft Widening	> 800 ft	Maximum design MR 10000 psi	Type IBL**, 14 in. lime soil modification	Lime only, perform MR test on molded specimens
SR/US/I	Widening or short length ≤ 800 feet long	≤ 800 ft	Maximum Design MR = 10000 psi (Max)	Type 1D Construct with 12 in. aggregate	Daylight subgrade for subgrade with high moisture or pavement patches greater than 50 ft.
SR/US/I	New Road, Reconstruction, or Widening	≤ 800 ft	Maximum Design MR = 10000 psi (Max)	Type 1C 12 in. coarse aggregate	Type 1C over wicking geotextile when moisture is high(2% over OMC)
SR/US/I	Reconstruction or Widening	≤ 800 ft	Maximum Design MR = 12000 psi	Type IV or Type IV A	Weak soils (MR < 5000 psi)
SR/US	Road Reconstruction or Widening < 8 ft	≤ 800 ft	Maximum Design MR = 6000 psi	Type II Construct with 6 in. aggregate	Type II subgrade over small patches over wicking geotextile
SR/US	Widening < 8 ft	≤ 800 ft	Maximum Design MR = 6000 psi	Type I	
Bike Path/Trails	Reconstruction or Widening	-	Maximum Design MR = 4500 psi	Type V or Type III 3 in. aggregate if over rail road bed or 6 in. In-place Moisture Density	-

\*Clay content ≤ 30% and PI ≤ 20

\*\* Clay content > 30% and PI > 20

SR- State Road

US- US Route

I- Interstate

# Chemical Modification of Soils

RSP 215-R-715



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# Section 218

## QC/QA for Soils Fill Sections and QC/QA for Subgrade

Newly Approved

# Cement Stabilized Subgrade Soils

Section 219



# Section 219 VS 215

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Cement Stabilized Subgrade Soil: 219

Chemical Modified Subgrade Soil: 215

- Strength: 300 psi for Cement Stabilized Subgrade (CSS).
- Strength Gain: 100 psi for Cement and 50 psi for Lime for Chemical Soil Modification
- Thickness: 12 inch for CSS, 14 inch for Modified Subgrade.
- Durability: CSS is greater than Modified Subgrade.
- Cement shall be used for CSS only.

# Section 219

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- Section 219 is QC/QA specifications.
- Quality Control is performed by contractor in accordance with ITM 803. Quality Control plan, QCP shall be submitted to INDOT.
- Quality Assurance is performed by INDOT in accordance with 219.

# Section 219

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## Description

- Stabilizing 12 in. soils by uniformly mixing Portland cement to achieve the desired unconfined compressive strength in accordance with 105.03.

## 219.02 Materials

- Material shall be in accordance with the following:
  - *Portland* Cement, Type I.....901.01(b)
  - Water.....913.01

Portland cement may be used dry or as a slurry

Soil shall meet the requirements of 215.02

# Section 219

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## Testing and Mix Design

- Testing and mix design shall be in accordance with 215.03.
- Contactor is responsible for all tests required to determine the optimum cement content for producing stabilized subgrade.
- Subgrade shall have minimum unconfined compressive strength of 300 psi at 7 days. (AASHTO T 208)
- The testing shall be performed by a Qualified Geotechnical Consultant. The list is available on the INDOT web site [www.in.gov/indot/files/approvedGeoConsultants.pdf](http://www.in.gov/indot/files/approvedGeoConsultants.pdf)

# Sec. 219.11, QC Testing

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- QC testing shall be performed by contractor.
- LWD tests for cement stabilized soils shall be performed on the finished grade in accordance with 203.24(b). LWD tests shall be every 1000 sq yd. Testing for Cement Stabilized Soil shall begin 7 days after compaction.
- Moisture Tests for Cement Stabilized Soils shall be performed in accordance with ITM 506 at every 1000 sq yd during cement and soils mixing



# Sec. 219.11, QC Testing

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- One gradation test in accordance with ITM 516 shall be performed at every 1000 sq yd of Cement Stabilized Soils.
- Cement spread rate and soil cement mixing depth shall be checked at every 2000 ft of length by lane width in accordance with ITM 516.
- Two test specimens shall be prepared at 95% of the Standard Proctor and cured for 7 days. Specimens shall be taken every 1000 ft and obtained by contractor. Unconfined compressive strength tests shall be performed in accordance with AASHTO T 208.



# Sec. 219.11, QA Testing

- Acceptance testing will be performed by INDOT.
- LWD test will be performed on the finished grade in accordance with 203.24(b). LWD tests will be every 2000 sq yd. Testing for Cement Stabilized Soil will begin at 7 days after compaction. The allowable average deflection and maximum deflection for Cement Stabilized Subgrade soil will be in accordance with the following:

Material Type	Allowable Average Deflection (mm)	Maximum Deflection at a Single Test Location (mm)
Cement Stabilized Subgrade Soil	0.14	0.17

- Moisture Tests for Cement Stabilized Soils mixture will be performed in accordance with ITM 506 at every 1000 ft during cement and soils mixing

# Indiana Test Methods (Revised 2020)

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- ITM 506-Field Determination of Soil Moisture
- ITM 508-Field Determination of Deflection w/LWD
- ITM 513-Determination of Intelligent Compaction
- ITM 514-Test Sections for Aggregates & Recycled Materials
- ITM 516-Spreading/Mixing/Identifying Chem. Modifiers
- ITM 803-Contractor Quality Control Plans

## **FIELD DETERMINATION OF MOISTURE CONTENT OF SOILS** **ITM No. 506-16T**

- This test method covers the procedure for determining the moisture content of soils in the field.
  - The stove or hot plate may be used for all types of soils.
  - The moisture probe may only be used for granular soils, not soils with material.
  - The microwave oven may be used for most soil types except for soils that contain high organic content, or dissolved soils in the pore water.

## **FIELD DETERMINATION OF DEFLECTION USING LIGHT WEIGHT DEFLECTOMETER - ITM No. 508-19T**

- This test method covers the determination of deflections with a Light Weight Deflectometer, LWD.
- The LWD may be used for structure backfill, coarse aggregates, chemically modified soils, or as directed by the Department.
- Only structure backfill size 1 1/2 in. and coarse aggregate Sizes No. 43, 53, and 73 shall be tested with the LWD
- LWD Test may be performed on Chemically Modified Soils and Cement Stabilized Subgrade (CSS)



## **DETERMINATION OF SOIL TARGET VALUES - ITM No. 513-21T**

- This method of test covers the procedure for determining the target Intelligent Compaction Measurement Value (IC-MV) of a soil.
  - The number of passes of the roller(s) to obtain the IC-MV at the required moisture content range of the soil is also determined.
  - This method of test also covers the procedure for determining the number of blow counts for 100% of standard Proctor.
  - This method of test also covers the procedure for determining the number of blow counts for 95% of Modified Proctor.
  - The target IC-MV is required to be monitored to verify changes in the soil or the roller response as lifts of the soil progress or conditions change. New test sections may be required when these changes occur.

## **TEST SECTIONS FOR AGGREGATES AND RECYCLED MATERIALS**

### **ITM No. 514- 21T**

- This test method describes a procedure by the construction of an aggregate or recycled materials test section using a Light Weight Deflectometer (LWD) to determine the maximum allowable deflection of LWD shall be used for aggregate, recycled concrete, or recycled asphalt pavement (RAP) test sections aggregate, DCP shall be used for foundry sand or coal ash test sections.
- Test sections shall be constructed in the presence of a representative of the Department with the available equipment of the Contractor.



## **SPREADING, MIXING & IDENTIFICATION OF CHEMICAL MODIFIERS IN SOIL STABILIZATION CONSTRUCTION - ITM 516-21P**

- This ITM describes field tests for soil modification/stabilization during construction.
- These tests are important for proper spreading, pulverization, and mixing of chemically treated soils.

## **CONTRACTOR QUALITY CONTROL PLANS**

### **ITM No. 803-21P**

- This procedure covers the preparation of a QCP by a Contractor. The QCP shall be provided, maintained, and followed to assure all materials furnished and placed for acceptance are in accordance with the contract requirements.

# Questions

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# 207.02 Materials

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## 207.02 Materials

Materials shall be in accordance with the following:

Chemical Modifiers.....	215.02
Coarse Aggregate, Class D or Higher, Size No. 5, 8, 43, 53, or 73 .....	904
Geogrid, Type IB .....	918.05
Geocell Confining System .....	214
<i>Geotextile for Pavement and Subgrade</i> .....	<i>918.02(c)</i>
Water .....	913.01

*Air-cooled blast furnace slag shall not be used for subgrade treatment Types ID, IV, and IVA.*

# 207.02 Materials-Soil Requirements

<i>Soil Property</i>	<i>Test Method</i>	<i>Requirements</i>
<i>Dry Weight Organic Material</i>	<i>AASHTO T 267</i>	$\leq 3\%$
<i>Max Dry Density</i>	<i>AASHTO T 99</i>	$\geq 100$ pcf
<i>Liquid Limit</i>	<i>AASHTO T 89</i>	$\leq 50$
<i>Soluble Sulfate</i>	<i>ITM 510</i>	$\leq 1000$ ppm

*Note:*

*Only soils meeting these requirements will be allowed within the specified thickness of the subgrade treatment in cut sections. Only soils meeting these requirements will be allowed within 24 in. of the finished subgrade elevation in fill sections.*

# 207.04 Subgrade Treatment Types

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*Type ID subgrade treatment shall be constructed with 9 in. of coarse aggregate No. 53 over 3 in. of coarse aggregate No. 5 or No. 8. Geotextile Type 2B in accordance with 918.02(c) shall be placed above and below the layer of No. 5 or No. 8 coarse aggregate.*



# 215.02 Materials

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Soils for chemical modification shall meet the following requirements:

<i>Soil Property</i>	<i>Test Method</i>	<i>Requirement</i>
<i>Maximum Dry Density</i>	<i>AASHTO T 99</i>	$\geq 90$ pcf
<i>Organic Material</i>	<i>AASHTO T 267</i>	$\leq 6\%$
<i>Sulfate Content</i>	<i>ITM 510</i>	$\leq 1,000$ ppm

# 215.08 Mixing

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## **215.08 Mixing**

The chemical modifier, soil, and water when necessary, shall be thoroughly mixed by rotary speed mixers ~~or a disc harrow~~. The mixing shall continue until a homogenous layer of the required thickness has been obtained. One hundred percent of the material, exclusive of rock particles, shall pass a 1 in. (25 mm) sieve and at least 60% shall pass a No. 4 (4.75 mm) sieve. The mixing depth shall be 14 in. *The gradation test shall be performed in accordance with ITM 516.*

*The chemically modified soil mixture shall be at least 1% above the optimum moisture content during mixing and compaction. Water shall not be added to the chemically modified soil when the moisture content of the soil exceeds 3% above optimum moisture. Water shall be added during mixing only.*

# 215.09 Compaction

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*Acceptance of chemically modified soils will be determined by averaging three LWD tests obtained at random stations determined in accordance with ITM 802. The deflection shall be equal to or less than the allowable average deflection shown in the table below.*

<i>Material Type</i>	<i>Allowable Average Deflection, (mm)</i>	<i>Maximum Deflection at a Single Test Location (mm)</i>
<i>Cement Modified Soils</i>	<i>0.27</i>	<i>0.31</i>
<i>Lime Modified Soils</i>	<i>0.30</i>	<i>0.35</i>

# 215.09 Compaction

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The chemically modified soil lift shall meet the following requirements for compaction:

- (a) The average DCP blow count shall not be less than 17 for the top 6 in. of a 14 in. lift.
- (b) The average DCP blow count shall not be less than 16 for the bottom 8 in. of a 14 in. lift.
- (c) ~~The average DCP blow count shall not be less than 20 for an 8 in. lift.~~ *Moisture tests for chemically modified soils mixture shall be performed in accordance with ITM 506 every 4 h during chemical and soils mixing.*
- (d) *One gradation test shall be performed for each 2,500 cu yds of chemically modified soil in accordance with 215.08 and ITM 516.*

# Requirements

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## Mix Design Requirements

Should include the following:

- Subgrade and its foundation
- Test: Textural and AASHTO Classification of soils, moisture content, pH, strength, and sulfate
- Type and source of the cement stabilizer: Cement stabilizer needs to be from an approved source and the list is available on the Division of Materials and Tests website: [www.in.gov/indot/div/mt/appmat/pubs/apl57.pdf](http://www.in.gov/indot/div/mt/appmat/pubs/apl57.pdf)
- Identify the specific limits of unstable foundation soils
- Mix Design proportion



# Section 219

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Soils shall meet the following requirements:

- Loss on ignition  $\leq$  6% by dry weight.....AASHTO T 267
- Max dry density  $\geq$  90 pcf.....AASHTO T 99
- Soluble sulfate content  $\leq$  1,000 ppm.....ITM 510

# Recommendations

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- Cement stabilized soils should be covered with pavement, as mixed design is not adequate for freeze and thaw cycle.
- Soils, water, cement and sulfate content should be checked.
- The grade should be checked prior to cement stabilization.