

SUPERSEDED BY EB 15-031 EFFECTIVE 9/28/15		New York State Department of Transportation ENGINEERING INSTRUCTION	EI 14-007														
Title: REVISION TO SECTION 402 - HOT MIX ASPHALT (HMA) PAVEMENTS																	
Target Audience: <table border="0"> <tr> <td>☒ Manufacturers (18)</td> <td>☐ Surveyors (33)</td> </tr> <tr> <td>☒ Local Govt. (31)</td> <td>☒ Consultants (34)</td> </tr> <tr> <td>☒ Agencies (32)</td> <td>☒ Contractors (39)</td> </tr> <tr> <td></td> <td>☐ _____ ()</td> </tr> </table>		☒ Manufacturers (18)	☐ Surveyors (33)	☒ Local Govt. (31)	☒ Consultants (34)	☒ Agencies (32)	☒ Contractors (39)		☐ _____ ()	Approved: <table border="0"> <tr> <td>/s/Robert L. Sack</td> <td>6/11/14</td> </tr> <tr> <td>Robert L. Sack, P.E.</td> <td>Date</td> </tr> <tr> <td>Deputy Chief Engineer, Research</td> <td></td> </tr> </table>		/s/Robert L. Sack	6/11/14	Robert L. Sack, P.E.	Date	Deputy Chief Engineer, Research	
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ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the Letting of September 4, 2014
- This EI does not supersede any other issuances. This EI modifies EI 10-009.
- The revisions issued with this EI will be incorporated into a future update of the Standard Specifications Book.

PURPOSE: The purpose of this EI is to revise Standard Specification Section 402, *Hot Mix Asphalt (HMA) Pavements*, specifically §402-3.04 *Rollers* and §402-3.07 *Compaction. D. 80 Series Compaction Method*.

TECHNICAL INFORMATION: This EI issues a revised Section 402 of the Standard Specifications for §402-3.04 *Rollers* and §402-3.07 *Compaction. D. 80 Series Compaction Method*. All information referencing the requirement for rollers to be on the Approved List for Hot Mix Asphalt has been deleted.

Cost Impact. There should be no cost increase due to implementation of this EI.

IMPLEMENTATION:

- Main Office Design Quality Assurance Bureau will insert revisions to the Standard Specification Section 402 into contract proposals beginning with projects submitted for the letting of September 4, 2014.
- Regional Special Specification Coordinators should review their 402 special specifications and amend accordingly.
- Engineers-in-Charge may incorporate these changes into ongoing projects or those let prior to the inclusion of the revisions to the Standard Specifications. A copy of this EI should be provided to the Contractor and a file copy included in the contract records as documentation of the change in accordance with the Contract Administration Manual (CAM) §104-02.

TRANSMITTED MATERIALS:

- Attached are both US Customary and Metric revisions to the Standard Specification for §402-3.04 *Rollers* and §402-3.07 *Compaction. D. 80 Series Compaction Method*.

BACKGROUND: The revisions to Section 402, transmitted with this issuance, were necessary to update the specification to reflect the elimination of the Department's Approved List for Hot Mix Asphalt (HMA) Vibratory Compaction Equipment. The Approved List for HMA vibratory rollers began when the Department evaluated each individual roller to achieve the required density. The technology and manufacture of the rollers has today exceeded the effectiveness needed for the Department's operations and the list is no longer needed.

CONTACT: Direct questions regarding this EI to Nazmul Hoque of the Materials Bureau at (518) 485-5428 or via e-mail at nazmul.hoque@dot.ny.gov or Sigrid Rantanen of the Materials Bureau at (518) 457-2074 or via e-mail at sigrid.rantanen@dot.ny.gov

Make the following changes to the Standard Specifications dated May 1, 2008:

Delete §402-3.04 *Rollers* and §402-3.07 *Compaction. D. 80 Series Compaction Method* and **replace** it with the following:

SECTION 402 - HOT MIX ASPHALT (HMA) PAVEMENTS

402-3.04 Rollers. Rollers can either be vibratory, oscillatory, static steel wheel type, or pneumatic tire rollers capable of compacting hot mix asphalt (HMA). The Engineer will inspect rollers prior to start of paving operations to determine acceptability. A minimum of two rollers, one for breakdown and one for finish rolling, are required unless the HMA placement is on a bridge deck, bridge approaches, or other areas where one roller may be sufficient to achieve the required density. Rollers must be in good mechanical condition, and capable of operating at speeds slow enough to avoid displacement of the mixture. The use of equipment which results in excessive crushing of aggregate will not be permitted. All manufacturers or suppliers must provide recommended settings for amplitude, frequency, and tire pressure (pneumatic) for each roller model for the thickness of pavement being rolled. The recommendations can either be on a sticker or a plate installed on the roller or a document readily available to the Engineer. For night time paving, the roller shall be equipped with at least one light on each fender, or alternatively, at least one light above the roller, visible from a distance of 200 feet. The roller shall also be equipped with an automatic audible warning signal when operating in reverse.

A. Vibratory and Oscillatory Rollers: The rollers shall be specifically designed for the compaction of HMA mixture. The roller shall be a self-propelled roller and shall have single or dual drums meeting the requirements as stated below. A roller shall weigh at least 8 tons and shall be capable of maintaining set frequency and amplitude.

i. Nominal Amplitude	0.05 inches, maximum
ii. Frequency	1500 vpm minimum
iii. Drum Width (dual drums)	54 inches, minimum
(single drum)	84 inches, minimum
iv. Speedometer	½ mph or 50 ft per minute increment, maximum
v. Speed limitation device	2 ½ mph or 220 ft per minute, maximum

Rollers shall be equipped with indicators that provide the operator with the speed, amplitude, and frequency setting readouts. The settings on the rollers shall be set such that it will produce a minimum of 12 impacts per foot during the compaction process. Otherwise, the settings shall be adjusted to meet this requirement.

Vibratory and oscillatory rollers shall be equipped with an automatic disconnect system that automatically shuts off the vibration and oscillation when the roller is in a stationary position. The roller must be equipped with a mechanical override system in the event of temporary failure of the automatic disconnect system.

B. Static Steel-wheel Rollers. These rollers shall be self-propelled two axle types. Static rollers shall be a minimum of 8 tons.

C. Pneumatic Rubber-tired Rollers: These rollers shall be self-propelled and consist of two axles on which multiple pneumatic-tired wheels are mounted in such a manner that the rear wheels shall not follow in the tracks of the forward wheels and will be spaced to give essentially uniform coverage with each pass. The axles shall be mounted in a rigid frame to provide means for adding ballast. The wheels shall be mounted so as to oscillate individually or in pairs. The tires must be smooth and show no tread pattern, be of equal size and diameter, and be uniformly inflated. Pneumatic rollers shall meet the following requirements unless otherwise approved:

i) Maximum Wheel Load	5,600 lbs
ii) Tire Compression on Pavement	80±5 psi
iii) Maximum Axle Load	22,400 lbs

D. Small Vibratory Rollers: These rollers shall be ride or walk behind type and have dual vibratory drums meeting the following requirements:

- i) Minimum Drum Width 24 inches
- ii) Minimum frequency 1500 vpm

402-3.07 Compaction.

D. 80 Series Compaction Method. Use one of the compaction options listed below for this method.

The number of passes listed in Table 402-6, *Number of Passes*, are recommended and may be increased or decreased by the Engineer to obtain adequate density. One vibratory pass is defined as one movement of a single drum of the roller over the pavement section in each direction. One static pass is defined as one movement of the roller over the pavement in each direction. Complete all breakdown roller passes before the mat temperature falls below 250°F. Remove all ruts, ridges, roller marks, or other irregularities from the surface using static rolling. All turning of the rollers must be performed on material which has had a minimum of one roller pass. The Engineer may approve alternate compaction procedures for areas where the specified procedures are not practical.

TABLE 402-6 NUMBER OF PASSES¹

Pavement Courses	Option 1 Three Roller Train (Static)		Option 2 Vibratory Rollers	
	Steel Wheel Rollers	Pneumatic Roller	Vibratory Passes	Static Passes
37.5 Base (Each Lift)	8	3	6	4
25.0 Binder	8	3	6	4
19.0 Binder	6	3	4	2
12.5 Top	6	3	4	2
9.5 Top	4	3	4	2
Permeable Base ²	-	-	-	2

1. Based on 12-foot lane width.

2. For the Permeable Base course, the mixture shall be compacted between 140°F and 230°F. Up to 2 additional passes may be required to obtain adequate density.

1. **Option 1 - Static Compaction.** Use this option only when the compacted thickness of the finished mat is 4 inches or less. The roller speeds shall not exceed 3 mph and will move at a uniform speed. The roller drive wheel or drum shall be nearest to the paver. When paving multiple lanes simultaneously, increase the required number of rollers proportionately for each additional full lane width unless otherwise approved by the Engineer. Under this option, compact the HMA mixtures with steel-wheel rollers operating in a static mode. Each pass shall overlap the previous roller pass by one-half the width of the roller.

Initially, compact the HMA with a steel-wheel roller immediately followed with a pneumatic rubber-tired roller. A minimum of 3 passes of the rubber-tired roller will be required. One pass is defined as one movement of the roller over any point of the pavement in either direction.

Use a steel-wheel roller for finish rolling the HMA to remove all shallow ruts, ridges, roller marks, and other irregularities from the surface.

When the compaction procedure fails to produce acceptable results, adjust the procedure to obtain the desired results.

2. **Option 2 - Vibratory Compaction.** Furnish a vibrating reed tachometer for the exclusive use of the Engineer. The vibrating reed tachometer must have a frequency range of 1,000 vpm to 4,000 vpm with a minimum reed interval of 50 vpm between 1,000 vpm and 2,000 vpm and a minimum reed interval of 100 vpm between 2,000 vpm and 4,000 vpm.

The settings on the rollers shall be set such that it will produce a minimum of 12 impacts per foot during the compaction process. Impacts are defined as the number of times a drum hits the pavement within one foot of travel.

The Engineer may verify this requirement by using the following formula:

$$\text{Impacts per foot} = \frac{\text{VPM}}{\text{Speed}}$$

VPM = Frequency of the roller (vibration per minute)

Speed = Speed of the roller (feet per minute)

If the impacts are less than the minimum, the settings and/or the speed shall be adjusted by the roller operator to meet at least the minimum requirement.

Operate the vibratory and oscillatory rollers at a uniform speed not to exceed 2 ½ mph (220 ft per minute) on all pavement courses. If satisfactory compaction is not obtained, or damage occurs to highway components and/or adjacent property using vibratory compaction equipment, immediately cease using this equipment and proceed with the work in accordance with compaction procedures stipulated under Option 1 at no additional cost to the State.

Make the following changes to the Standard Specifications dated May 4, 2006 as modified by EI 10-009: **Delete** §402-3.04 Rollers and §402-3.07 Compaction. D. 80 Series Compaction Method and **replace** it with the following:

SECTION 402 - HOT MIX ASPHALT (HMA) PAVEMENTS

402-3.04 Rollers. Rollers can either be vibratory, oscillatory, static steel wheel type, or pneumatic tire rollers capable of compacting hot mix asphalt (HMA). The Engineer will inspect rollers prior to start of paving operations to determine acceptability. A minimum of two rollers, one for breakdown and one for finish rolling, are required unless the HMA placement is on a bridge deck, bridge approaches, or other areas where one roller may be sufficient to achieve the required density. Rollers must be in good mechanical condition, and capable of operating at speeds slow enough to avoid displacement of the mixture. The use of equipment which results in excessive crushing of aggregate will not be permitted. All manufacturers or suppliers must provide recommended settings for amplitude, frequency, and tire pressure (pneumatic) for each roller model for the thickness of pavement being rolled. The recommendations can either be on a sticker or a plate installed on the roller or a document readily available to the Engineer. For night time paving, the roller shall be equipped with at least one light on each fender, or alternatively, at least one light above the roller, visible from a distance of 60 meters. The roller shall also be equipped with an automatic audible warning signal when operating in reverse.

A. Vibratory and Oscillatory Rollers: The rollers shall be specifically designed for the compaction of HMA mixture. The roller shall be a self-propelled roller and shall have single or dual drums meeting the requirements as stated below. A roller shall weigh at least 8 metric tons and shall be capable of maintaining set frequency and amplitude.

- | | | |
|------|-------------------------|---|
| i. | Nominal Amplitude | 1.25 mm, maximum |
| ii. | Frequency | 25 Hz, minimum |
| iii. | Drum Width | (dual drums) 1.3 m, minimum |
| | | (single drum) 2.1 m, minimum |
| iv. | Speedometer | 1 km/hr or 15 m per minute increment, maximum |
| v. | Speed limitation device | 4 km/hr or 67 m per minute, maximum |

Rollers shall be equipped with indicators that provide the operator with the speed, amplitude, and frequency setting readouts. The settings on the rollers shall be set such that it will produce a minimum of 36 impacts per meter during the compaction process. Otherwise, the settings shall be adjusted to meet this requirement.

Vibratory and oscillatory rollers shall be equipped with an automatic disconnect system that automatically shuts off the vibration or oscillation when the roller is in a stationary position. The roller must be equipped with a mechanical override system in the event of temporary failure of the automatic disconnect system.

B. Static Steel-wheel Rollers. These rollers shall be self-propelled two axle types. Static rollers shall be a minimum of 8 metric tons.

C. Pneumatic Rubber-tired Rollers: These rollers shall be self-propelled and consist of two axles on which multiple pneumatic-tired wheels are mounted in such a manner that the rear wheels shall not follow in the tracks of the forward wheels and will be spaced to give essentially uniform coverage with each pass. The axles shall be mounted in a rigid frame to provide means for adding ballast. The wheels shall be mounted so as to oscillate individually or in pairs. The tires must be smooth and show no tread pattern, be of equal size and diameter, and be uniformly inflated. Pneumatic rollers shall meet the following requirements unless otherwise approved:

i) Maximum Wheel Load	2600 kg
ii) Tire Compression on Pavement	550 ± 35 kPa
iii) Maximum Axle Load	10,160 kg

D. Small Vibratory Rollers: These rollers shall be ride or walk behind type and have dual vibratory drums meeting the following requirements:

- i) Minimum Drum Width 0.6 m
- ii) Minimum frequency 25 Hz

402-3.07 Compaction.

D. 80 Series Compaction Method. Use one of the compaction options listed below for this method.

The number of passes listed in Table 402-6, *Number of Passes*, are recommended and may be increased or decreased by the Engineer to obtain adequate density. One vibratory pass is defined as one movement of a single drum of the roller over the pavement section in each direction. One static pass is defined as one movement of the roller over the pavement in each direction. Complete all breakdown roller passes before the mat temperature falls below 120°C. Remove all ruts, ridges, roller marks, or other irregularities from the surface using static rolling. All turning of the rollers must be performed on material which has had a minimum of one roller pass. The Engineer may approve alternate compaction procedures for areas where the specified procedures are not practical.

TABLE 402-6 NUMBER OF PASSES¹

Pavement Courses	Option 1 Three Roller Train (Static)		Option 2 Vibratory Rollers	
	Steel Wheel Rollers	Pneumatic Roller	Vibratory Passes	Static Passes
37.5 Base (Each Lift)	8	3	6	4
25.0 Binder	8	3	6	4
19.0 Binder	6	3	4	2
12.5 Top	6	3	4	2
9.5 Top	4	3	4	2
Permeable Base ²	-	-	-	2

1. Based on 3.6- meter lane width.

2. For the Permeable Base course, the mixture shall be compacted between 60°C and 110°C. Up to 2 additional passes may be required to obtain adequate density.

1. **Option 1 - Static Compaction.** Use this option only when the compacted thickness of the finished mat is 100 mm or less. The roller speeds shall not exceed 5 km/hr and will move at a uniform speed. The roller drive wheel or drum shall be nearest to the paver. When paving multiple lanes simultaneously, increase the required number of rollers proportionately for each additional full lane width unless otherwise approved by the Engineer. Under this option, compact the HMA mixtures with steel-wheel rollers operating in a static mode. Each pass shall overlap the previous roller pass by one-half the width of the roller.

Initially, compact the HMA with a steel-wheel roller immediately followed with a pneumatic rubber-tired roller. A minimum of 3 passes of the rubber-tired roller will be required. One pass is defined as one movement of the roller over any point of the pavement in either direction.

Use a steel-wheel roller for finish rolling the HMA to remove all shallow ruts, ridges, roller marks, and other irregularities from the surface. When the compaction procedure fails to produce acceptable results, adjust the procedure to obtain the desired results.

- 2. Option 2 - Vibratory Compaction.** Furnish a vibrating reed tachometer for the exclusive use of the Engineer. The vibrating reed tachometer must have a frequency range of 20 Hz to 80 Hz with a minimum reed interval of 1 Hz between 20 Hz and 40 Hz and a minimum reed interval of 2 Hz between 40 Hz and 80 Hz.

The settings on the rollers shall be set such that it will produce a minimum of 36 impacts per meter during the compaction process. Impacts are defined as the number of times a drum hits the pavement within one meter of travel.

The Engineer may verify this requirement by using the following formula:

$$\text{Impacts per meter} = \frac{\text{Hz}}{\text{Speed}}$$

Hz = Frequency of the roller (vibration per minute)

Speed = Speed of the roller (meter per minute)

If the impacts are less than the minimum, the settings and/or the speed shall be adjusted by the roller operator to meet at least the minimum requirement.

Operate the vibratory rollers at a uniform speed not to exceed 4 km/hr (67 m per minute) on all pavement courses. If satisfactory compaction is not obtained, or damage occurs to highway components and/or adjacent property using vibratory compaction equipment, immediately cease using this equipment and proceed with the work in accordance with compaction procedures stipulated under Option 1 at no additional cost to the State.