7. T 103 – Standard Method of Test for Soundness of Aggregates by Freezing and Thawing

8. T 104 – Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

9. T 164 – Standard Method of Test for Quantitative Extraction of Asphalt Binder from Hot Mix Asphalt

10. T 166 – Standard Method of Test for Bulk Specific Gravity (Gmb) of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface-Dry Specimens

11. T 245 – Standard Method of Test for Resistance to Plastic Flow of Asphalt Mixtures Using Marshall Apparatus

B. American Society for Testing and Materials (ASTM)

1. D1559 – Test Method for Resistance of Plastic Flow of Bituminous Mixtures using Marshall Apparatus

2. D2726 – Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures

1.3. DEFINITIONS

A. Asphalt Pavements

1. One or more courses of an asphaltic mixture consisting of asphaltic-coated mineral aggregates constructed on a prepared foundation.

B. Reclaimed Asphaltic Pavement

1. Material resulting from cold milling or crushing existing asphaltic pavement.

C. Acronyms

1. HMA Hot Mix Asphalt

2. PG Performance Graded

3. RAP Reclaimed Asphaltic Pavement

1.4. SUBMITTALS

A. Submit test results from the CONTRACTOR’s Quality Control Program including:

1. Aggregates.

2. Asphaltic Materials.

3. Asphalt Mix Design.

PART 2 - PRODUCTS

2.1. MATERIALS

A. Aggregates

Aggregate Gradation Mater Range and VMA Requirements					
Sieve	**Percent Passing Designated Sieves**				
	Nominal Size				
	No. 1 (37.5 mm)	**No. 2 (25.0 mm)**	**No. 3 (19.0 mm)**	**No. 4 (12.5 mm)**	**No. 5 (9.5 mm)**
50.0 mm	100				
37.5 mm	90 – 100	100			
25.0 mm	90 max.	90 – 100	100		
19.0 mm	—	90 max.	90 – 100	100	
12.5 mm	—	—	90 max.	90 – 100	100
9.5 mm	—	—	—	90 max.	90 – 100
4.75 mm	—	—	—	—	90 max.
2.36 mm	15 – 41	19 – 45	23 – 49	28 – 58	32 – 67
0.60 mm	—	—	—	—	—
75 µm	0 – 6.0	1.0 – 7.0	2.0 – 8.0	2.0 – 10.0	2.0 – 10.0
% Minimum VMA	11.0	12.0	13.0	14.0[(1)]	15.0[(2)]

[(1)] 14.5 for LT and MT mixes.

[(2)] 15.5 for LT and MT mixes.

B. Asphaltic Materials

1. Minimum binder grade: PG 58-28 S

C. Tack Coat

1. Acceptable types: MS-2, SS-1, SS-1h, CSS-1, CSS-1h, QS-1, QS-1h, CQS-1, CQS-1h, or modified emulsified asphalt.

D. Mix Design

1. Meet the following mixture requirements:

Mixture Requirements			
Mixture Type	**LT**	**MT**	**HT**
LA Wear (AASHTO T96)			
100 revolutions (max % loss)	13	13	13
500 revolutions (max % loss)	50	45	45
Soundness (AASHTO T104) (sodium sulfate, max % loss)	12	12	12

Mixture Requirements (continued)			
Mixture Type	**LT**	**MT**	**HT**
Freeze/Thaw (AASHTO T103) (specified counties, max % loss)	18	18	18
Fractured Faces (ASTM D5821 as modified in CMM 8-60) (one face/2face, % by count)	65/___	75 / 60	98 / 90
Flat & Elongated (ASTM D4791) (max %, by weight)	5 (5:1 ratio)	5 (5:1 ratio)	5 (5:1 ratio)
Fine Aggregate Angularity (AASHTO T304, method A, min)	40	43	45
Sand Equivalency (AASHTO T176, min)	40	40	45
Clay Lumps and Friable Particle in Aggregate (AASHTO T112)	< = 1%	< = 1%	< = 1%
Plasticity Index of Material Added o Mix Design as Mineral Filler (AASHTO T89/90)	< = 4	< = 4	< = 4
Gyratory Compaction			
Gyrations for N_{ini}	6	7	8
Gyrations for N_{des}	40	75	100
Gyrations for N_{max}	60	115	160
Air Voids, %Va ($\%G_{mm}$ N_{des})	4.0 (96.0)	4.0 (96.0)	4.0 (96.0)
% G_{mm} N_{ini}	< = 91.5[1]	< = 89.0[1]	< = 89.0
% G_{mm} N_{max}	< = 98.0	< = 98.0	< = 98.0
Dust to Binder Ratio[2] (% passing 0.075/P_{be})	0.6 – 1.2	0.6 – 12.1	0.6 – 1.2
Voids filled with Binder (VFB or VFA, %)	68 – 80[4][5]	65 – 75[3][5]	65 – 75[3][5]
Tensile Strength Ratio (TSR)(AASHTO T283)[6][7]			
No antistripping additive	0.75 min	0.75 min	0.75 min
With antistripping additive	0.80 min	0.80 min	0.80 min
Draindown (AASHTO T305)(%)	___	___	___

[1] The percent maximum density at initial compaction is only a guideline.

[2] For a gradation that passes below the boundaries of the caution zone (ref. AASHTO M323), the dust to binder ratio limits are 0.6 – 1.6.

[3] For no. 5 (9.5 mm) and No. 4 (12.5 mm) nominal maximum size mixtures, the specified VFB range is 70 – 76 percent.

[4] For no. 2 (25.0 mm) nominal maximum size mixes, the specified VFB lower limit is 67 percent.

[5] For No. 1 (37.5 mm) nominal maximum size mixes, the specified VFB lower limit is 67 percent.

[6] WisDOT eliminates freeze-thaw conditioning cycles from the TSR test procedures.

[7] Run TSR at asphalt content corresponding to 3.0% air void regressed design, or 4.5% air void design for SMA, using distilled water for testing.

2.2. SOURCE QUALITY CONTROL

A. Perform the following tests daily:

1. Aggregate gradation.

2. Asphalt content.

3. Bulk specific gravity.

4. Maximum specific gravity.

5. Air voids (Va).

6. Voids in mineral aggregate (VMA).

B. Document observations, inspection records, mixture adjustments, and test results daily.

PART 3 - EXECUTION

3.1. PREPARATION OF FOUNDATION

A. Aggregate Base Course

1. Scarify, shape, trim, and compact the surface of base aggregate where necessary to provide the required cross-sectional contour, a profile free from abrupt changes in elevations and a surface free from pits, hollows, depressions or projections above the normal surface.

2. Shape and trim using long-wheel-base motor graders or sub-grade finishers designed for the purpose.

3. Proof roll existing base aggregate using a loaded tandem axle truck. Remove and reconstruct areas showing appreciable displacement either laterally or longitudinally.

B. Asphaltic Treated Surfaces & Pavements

1. Prepare sections of existing asphaltic surfaces that are to remain in place by removing all localized areas that exhibit a tendency to ravel, shove, bleed or are otherwise unsuitable to serve as a base for the proposed asphaltic resurfacing.

2. Clean all loose material from holes or pits in the existing asphaltic surface and fill with asphaltic surface mixture furnished under the appropriate item of the Contract.

C. Concrete Pavements

1. Remove surplus crack and joint sealing material from the surface of the pavement.

2. Remove protruding joint materials, including fillers and sealers, from joints and cracks to at least the surface of the existing concrete.

3. Completely remove unstable patches of asphaltic materials used to fill localized pits, depressions or badly spalled or disintegrated areas of the old pavement to the underlying concrete. Remove loose concrete or concrete with incipient spalling within or contiguous to such areas.

3.2. CONSTRUCTION

A. Tack Coat

1. Apply tack coat only when the air temperature is 32°F or more, and when the surface of the previously prepared base or existing surface is dry and reasonably free of loose dirt, dust or other foreign matter. Do not apply to surfaces with standing water, when the weather or roadbed conditions are unfavorable, or prior to impending rains.

2. Apply tack coat at the rate of 0.050 to 0.070 gallons per square yard, after dilution.

3. Apply tack coat to approximately that area of the surface that can reasonably be expected to be paved during the same day.

4. Keep tack coat free of contaminants that may affect bond.

B. Transportation & Delivery of Mixtures

1. General

a. Deliver the mixture to the paver receiving hopper at temperatures not lower than 250°F or within 20°F of the recommended plant mix temperature range given in the mixture design.

b. Cover all loads during inclement weather, when the ambient air temperature falls below 65°F, or when the length of haul would cause a loss of mixture temperature greater than 20°F from the designated delivery temperature.

c. Deliver and place mixture during daylight hours, unless artificial light satisfactory to the OWNER is provided.

2. Delivery Tickets

a. Furnish delivery tickets with each load of asphalt pavement containing the following information:

1) Date and time dispatched.

2) Name of asphaltic concrete plant.

3) Project name and location of delivery.

4) Truck number.

5) Type of material (i.e. binder, surface, asphaltic material for driveway or trail).

6) Asphalt grade designation.

7) Gross weight of the vehicle, tare weight of the vehicle and subtraction to obtain the net weight.

8) Signature of responsible party representing the CONTRACTOR.

b. If only a partial load of asphaltic material is used on the project, weigh the truck again with the remaining material to determine the actual weight of the material used. Show this information on the original ticket for that load.

C. Spreading & Finishing Mixture

1. General

a. Place asphaltic mixture only on a prepared, firm and compacted base, foundation course or existing pavement, which is substantially surface-dry and free of loose and foreign material.

b. Reject asphaltic mixture which, in the judgment of the ENGINEER, is not sufficiently mixed or is defective in any manner.

c. Remove and replace material that is loose and broken, mixed with dirt, or is otherwise unacceptable with fresh hot mixture. Also remove and replace areas with excess asphaltic material. Compact replaced mixture immediately flush with the adjacent pavement.

2. Weather Limitations

a. Do not place asphaltic mixture when the air temperature approximately 3 feet above ground at the site of the work, in the shade and away from the effects of artificial heat, is less than 36°F for upper layers or 32°F for lower layers.

b. Do not place asphaltic mixture over frozen sub-grade or base or where the roadbed underlying the foundation or base is temporarily unstable from the effects of frost heaving.

c. Do not place asphaltic mixture when it is raining or snowing. Remove and replace any mixture exposed to rain or snow before final rolling which has, in the judgment of the ENGINEER, been adversely affected. This will be at the CONTRACTOR's expense.

3. Pavers

   a. Ensure the screed or strike-off assembly produces a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Use a screed adjustable for the required crown and cross-section of the finished pavement.

   b. Ensure that pavers are equipped with a vibratory screed or strike-off assembly and use vibration at all times during paving. Do not extend the screed with one or more static extensions totaling more than 12-inches at either screed.

   c. Provide pavers with automatic controls for elevation and slope of the screed.

4. Joints

   a. Offset longitudinal joints from the preceding layer by 6-inches with the joint in the top layer at the centerline or lane line location.

   b. When placing an asphaltic mat next to an older asphaltic mat, saw the old mat back on a straight line to provide a butt-joint for the full depth of the new mat.

   c. Clean longitudinal and transverse joints that have become coated with dust. If necessary, paint with hot asphalt cement, cutback or emulsified asphalt to ensure a tightly bonded and sealed joint.

5. Adjusting Manholes, Catch Basins, Inlets & Valves

   a. Adjust manholes, catch basins, inlets, valves and other fixtures to the required alignment and grade. This work includes the repair of the upper-most 12-inches of the existing concrete masonry manhole, catch basin, or inlet structure.

END OF SECTION

SECTION 32 13 13.00

CONCRETE PAVEMENTS

PART 1 – GENERAL

1.1. SUMMARY

A. Section Includes

1. Material requirements, reinforcement, joints, placement procedures, and testing procedures.

B. Measurement Procedures

1. Concrete Pavement

a. Measured by the square yard, unless otherwise specified in the Contract Documents.

b. Fillets for widened sections will be measured as pavement.

c. A measured deduction for fixtures in the pavement will be made if the following exist:

1) The surface area of the fixture is greater than 9 square feet.

2. Reinforcement and dowel basket assemblies are included within concrete pavement. If a separate Bid Item exists for reinforcement or dowel baskets, these will be measured in accordance with the Contract Documents.

C. Payment Procedures

1. Concrete Pavement

a. Pay for concrete pavement by the square yard, unless specified otherwise in the Contract Documents.

b. Price includes:

1) Furnishing, installing, curing and protecting all materials incorporated into the work.

2) Saw cutting, jointing, sealing joints, reinforcement, preparation of the foundation, adjusting fixtures, testing, and required submittals.

2. Reinforcement

a. If a Bid Item exists, pay reinforcement according to the Specifications.

b. If no Bid Item exists, reinforcement is considered part of the concrete pavement. No additional compensation will be provided.

1.2. REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

1. C260 – Standard Specification for Air-Entraining Admixtures for Concrete

2. M31 – Standard Specification for Deformed and Plain Carbon and Low-Alloy Steel Bars for Concrete Reinforcement

3. M43 – Standard Specification for Sizes of Aggregate for Road and Bridge Construction

4. M153 – Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

5. M213 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

6. T11 – Standard Method of Test for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing

7. T19 – Standard Method of Test for Bulk Density ("Unit Weight") and Voids in Aggregates

8. T21 – Standard Method of Test for Organic Impurities in Fine Aggregates for Concrete

9. T22 – Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens

10. T23 – Standard Method of Test for Making and Curing Concrete Test Specimens in the Field

11. T24 – Standard Method of Test for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

12. T27 – Standard Method of Test of Sieve Analysis of Fine and Coarse Aggregate

13. T71 – Standard Method of Test for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar

14. T84 – Standard Method of Test for Specific Gravity and Absorption of Fine Aggregate

15. T85 – Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate

16. T103 – Standard Method of Test for Soundness of Aggregates by Freezing and Thawing

17. T104 – Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

18. T113 – Standard Method of Test for Lightweight Particles in Aggregate

19. T152 – Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method

B. American Society for Testing and Materials (ASTM)

1. C150 – Standard Specification for Portland Cement

2. C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

3. C494 – Standard Specification for Chemical Admixtures for Concrete

4. C1260 – Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

5. C1567 – Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combination of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

6. D3542 – Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Bridges

7. D4791 – Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

8. D6690 – Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

1.3. SUBMITTALS

A. Manufacturer's Certifications

1. Submit the following a minimum of 10 days prior to incorporation into the work for review by the ENGINEER:

a. Certified test analysis for all elements of the specifications both physical and chemical.

b. Certificate of compliance, signed by a responsible company officer, stating all material furnished meets Contract Specifications.

B. Materials

1. Submit the following certifications a minimum of 10 days prior to incorporating a material into the work for review by the ENGINEER:

a. Portland Cement

1) A manufacturer's written certification stating the source, amount, and composition of essential constituents and the composition of the final cement.

b. Reinforcement

1) A manufacturer's certified report of test or analysis showing the reinforcement conforms to the specification.

c. Expansion Joint Filler

1) A manufacturer's written certification stating it conforms to AASHTO M153 or AASHTO M213.

d. Joint Sealer

1) A manufacturer's written certification stating it is a gray sealant complying with ASTM D6690 for non-sagging grade NS, Class 25, traffic area use T, and either single-component Type S, or multi-component Type M.

e. Pre-Formed Elastomeric Compression Joint Sealers

1) A manufacturer's written certification stating it conforms to ASTM D3542.

f. Concrete Curing Compounds

1) A manufacturer's written certification stating Poly-Alpha-Methylstyrene (PAM) liquid curing compound conforms to ASTM C309, Type 2, Class B.

g. Aggregates

1) Sampling and test results according to the following:

a)	Lightweight Pieces in Aggregate	AASHTO T113
b)	Material Finer than No. 200 Sieve	AASHTO T11
c)	Unit Weight of Aggregate	AASHTO T19
d)	Organic Impurities in Sands	AASHTO T21

e)	Sieve Analysis of Aggregates	AASHTO T27
f)	Effect of Organic Impurities in Fine Aggregate	AASHTO T71
g)	Alkali Silica Reactivity of Aggregates	ASTM C1260
h)	Alkali Silica Reactivity of Combinations of Cementitious Materials and Aggregates	ASTM C1567
i)	Freeze-Thaw Soundness of Coarse Aggregate (Procedure B, 16 Cycles, with Methyl Alcohol)	AASHTO T103
j)	Sodium Sulfate Soundness of Coarse Aggregated (R-4, 5 Cycles)	AASHTO T104
k)	Specific Gravity and Absorption of Fine Aggregate	AASHTO T84
l)	Specific Gravity and Absorption of Coarse Aggregate	AASHTO T85
m)	Flat & Elongated Pieces Based on a 3:1 Ratio	ASTM D4791

C. Mix Design

1. Submit a mix design a minimum of 10 days prior to incorporation into the work for review by the ENGINEER.

2. Submit the brand and source for each cement used on the project.

3. Include the following in the mix design:

a. Any necessary adjustments for the specific gravity of the aggregates used.

b. Any necessary adjustments to master limits of the job mix required by the Contract Specifications.

PART 2 – PRODUCTS

2.1. CONCRETE MATERIALS

A. General

1. Concrete must consist of Portland cement, fine aggregate, coarse aggregate, and water proportioned and mixed according to the following:

a. Portland Cement

1) Type I Portland cement; ASTM C150.

2) Type II Portland cement: ASTM C150

3) Type III Portland cement; ASTM C150 for high early strength.

b. Air Entraining Admixtures

1) Conforms to AASHTO C260 for 7- and 28-day compressive and flexural strengths and resistance to freezing and thawing.

c. Retarding and Water Reducing Admixtures

1) Retarding admixtures must conform to ASTM C494, Type B.

2) Water reducing admixtures must conform to ASTM C494 Type A or D.

3) Do not add Type A and D admixtures to the same batch of concrete.

d. Water

1) Acceptable Water

a) Drinking water from municipal water supplies.

b) From other sources meeting the following requirements:

(1) Acidity, maximum of 0.1N NaOH to neutralize 200mL of water: 2mL
(2) Alkalinity, maximum of 0.1N HCL to neutralize 200 mL of water: 15 mL
(3) Maximum sulphate (SO4): 0.05%
(4) Maximum chloride: 0.10%
(5) Maximum total solids:
(a) Organic: 0.04%
(b) Inorganic: 0.15%

c) If utilizing water from non-municipal water supply, test at least 2 quarts of water for conformance with the listed requirements.

e. Aggregates

1) Fine Aggregates

a) Consisting of a combination of sand with fine gravel, crushed gravel, or crushed stoned consisting of hard, strong, durable particles.

b) Do not exceed the following percentages of deleterious materials:

Substance	Percent by Weight
Material Passing the No. 200 Sieve	3.5
Coal	1.0
Clay Lumps	1.0
Shale	1.0
Other Deleterious Substances Like Alkali, Mica, Coated Grains, Soft and Flaky Particles	1.0

c) Do not exceed a total of 3.0% by weight of coal, clay lumps, shale, and other deleterious substances.

d) Acceptable gradation:

Sieve	Percent Passing by Weight
3/8-Inch	100
No. 4	90–100
No. 16	45–85
No. 50	5-30
No. 100	0-10

2) Coarse Aggregates

a) Consisting of clean, hard, durable gravel, crushed gravel, crushed stone, or crushed concrete free of an excess of flat and elongated pieces.

Do not exceed the following percentages of deleterious materials:

Substance	Percent by Weight
Material Passing the No. 200 Sieve	1.5
Coal	1.0
Clay Lumps	0.3
Soft Fragments	5.0
Shale	1.0
Flat & Elongated Pieces Based on a 3:1 Ratio	15
Lightweight Pieces (material having a saturated surface-dry bulk specific gravity of less than 2.45) (AASHTO T113)	5.0

b) Do not exceed a total of 5.0% by weight of coal, clay lumps, shale, and soft fragments.

c) Acceptable physical properties:

(1) Percent wear 50 or less.
(2) Soundness loss 12% or less.
(3) Freeze-thaw average loss 18% or less.

d) Acceptable gradations:

Sieve	Percent Passing by Weight AASHTO M43	
	Size No. 1 AASHTO No. 67	Size No. 2 AASHTO No. 4
2-Inch	-	100
1½-Inch	-	90-100
1-Inch	100	20-55
¾-Inch	90-100	0-15
3/8-Inch	20-55	0-5
No. 4	0-10	-
No. 8	0-5	-

e) Composition of Concrete

(1) Conform to master limits in following chart:

Concrete Grade (2)(3)	Quantities for a Nominal Cubic Yard (1)						
	Cement (lb)	Class C Fly Ash (lb)	Slag (lb)	Weight Total Agg (lb)	Percent Fine Agg(4) (% total agg)	Design Water (gals)	Maximum Water (gals)
A	565	-	-	3120	30-40	27	32
A-FA (5)	395	170	-	3080	30-40	27	32
A-S (5)	395	-	170	3100	30-40	27	32
A-T (5)	395	Total fly ash and slag of 170 (6)		3090	30-40	27	32
C	660	-	-	2980	30-40	30	36
E	823	-	-	2810	50	32	35

(1) A nominal cubic yard has the tabulated weights of cement and aggregate, design mix water, and 6.0% air.
(2) For all grades, use a water-reducing admixture conforming to 501.2.3.3 and 501.3.2.4.4.
(3) For all grades, provide air entrainment as specified in 501.3.2.4.2.
(4) If using crushed stone or crushed concrete coarse aggregate, the ENGINEER may allow up to 45% fine aggregate.
(5) If using less than the tabulated maximum quantities of fly ash or slag, calculate the cement content by reducing the base cement content for the Grade A mix by the weight of fly ash or slag added.
(6) For ternary mixes containing cement, fly ash, and slag, if using less than the tabulated maximum combined quantity of fly ash and slag calculate the cement content by reducing the base cement content for the Grade A mix by the combined weight of fly ash and slag added.

(2) Use concrete Grade A unless specified otherwise in the Specifications.

f) High Early Strength Concrete

(1) If high early strength concrete is required by the specifications or chosen by the CONTRACTOR, it may be supplied with the following:

(a) High early strength cement (Type III).
(b) An additional amount of the same cement used in the original mix conforming to the Grade C or Grade E master limits.

(2) There will be no additional compensation if CONTRACTOR chooses high early strength concrete.

2.2. REINFORCEMENT

A. Provide epoxy coated reinforcement including dowel bars, tie bars, metal chairs, tie wire, and other appurtenances conforming to AASHTO M31.

2.3. EXPANSION JOINT FILLER

A. Conforms to AASHTO M153 or AASHTO M213.

2.4. JOINT SEALER

A. Conforms to ASTM D6690 Type II.

2.5. PRE-FORMED ELASTOMERIC COMPRESSION JOINT SEALERS

A. A manufacturer's written certification stating it conforms to ASTM D3542.

2.6. CONCRETE CURING MATERIALS

A. Poly-Alpha-Methylstyrene (PAM) liquid curing compound conforming to ASTM C309, Type 2, Class B; polyethylene sheeting and burlap.

2.7. EQUIPMENT

A. Acceptable concrete mixing sources:

1. Automatic or Semi-Automatic Batch Plants

2. Ready-Mixed Concrete plants

PART 3 – EXECUTION

3.1. PREPARATION

A. Preparation of Foundation

1. Includes, but is not limited to the following:

a. Repair unstable areas in the base course.

b. Place new base course in order to achieve pavement ready condition.

2. Preparation of Aggregate Base Course

a. Scarify, shape, trim, and compact the surface of base aggregate where necessary to provide the required cross-sectional contour, a profile free from abrupt changes in elevations and a surface free from pits, hollows, depressions or projections above the normal surface.

b. Shape and trim the foundation to the plan required line, grade, and cross section using long-wheel-base motor graders or sub-grade finishers designed for the purpose. Prepare foundation areas by hand or other methods approved by the ENGINEER if machine methods are impractical.

c. Prepare the foundation 1 foot wider on each side of the planned new pavement width (2 feet wider for integral pavement), or as shown on the plans.

d. Proof roll existing base aggregate using a loaded tandem axle truck. Remove and reconstruct areas showing appreciable displacement either laterally or longitudinally.

e. Moisten the foundation with water no less than 6 hours prior to placing the concrete. Provide moist but not saturated foundation at the time of placing concrete.

f. Prepare no less than 300 feet of foundation in advance of concrete placement operations unless approved by the ENGINEER.

B. Saw Cutting

1. Sawcut all pavements to be removed, as shown on the plans, or specified by the ENGINEER.

2. Perform saw cutting according to the following:

a. Place full depth saw cuts as indicated on the plans.

b. Perform saw cutting so that the surface to remain is vertical for its full depth.

C. Adjust Catch Basins, Inlets, Manholes, and Valve Boxes

1. Adjust catch basins, inlets, manholes, valve boxes, and other fixtures to the plan grade and alignment.

2. Catch basin, inlet, and manhole adjustment includes the repair of the uppermost 12-inches of the existing masonry structure.

3.2. CONSTRUCTION

A. Placing Concrete

1. Use self-propelled slip-form paving equipment wherever possible.

2. Slip-Form Paving

a. Advance the paving train at a uniform pace stopping and starting the paver as little as possible. If it is necessary to stop the forward movement of the paver, stop vibrating and tamping immediately, and restart when forward motion resumes.

b. Ensure that concrete is uniformly consolidated, free from honey combed areas, and has a consistent void-free closed surface.

c. Use machine methods to strike-off and consolidate the concrete as much as possible. Keep hand finishing efforts to a minimum to avoid over finishing. Hand-float the surface only as needed to produce a uniform surface and sharp corners. Do not use excess mortar to build up slab edges or round the slab corners.

d. Maintain an edge slump, exclusive of edge rounding, no greater than 3/8 inch at free edges or 1/8 inch where abutting other concrete. Correct excessive edge slump before concrete hardens and adjust operations to reduce edge slump to an acceptable lever. Tool pavement edges to a ¼-inch radius.

3. Formed Placement

a. Deposit concrete as near as possible to its final location. Consolidate uniformly throughout the depth and systematically across the are to produce a dense, homogenous pavement.

b. Strike off with vibrating screeds. Maintain a uniform quantity of concrete in front of the screed sufficient to fill voids or low areas. Do not make more than two (2) passes of the screed on a given area of concrete. Do not vibrate the concrete with the screed in a stationary position.

c. Augment vibrating screeds with internal vibration in front of the screed for placements over 5-inches deep. Insert single spud hand vibrators vertically in a grid pattern just long enough to bring mortar to the surface. Ensure that areas visibly affected by successive vibrator insertions overlap

by 2 to 3-inches. Do not drag spud vibrators through the concrete or move concrete laterally by vibration.

d. Use single spud hand vibrators to consolidate the concrete adjacent to transverse construction joints and along the full length of dowel basket assemblies. Vibrate to a depth that consolidates the concrete above and below the dowel bars. Vibrate along the forms as required to achieve a void-free formed edge. Do not allow vibrators to contact reinforcement, forms, or the grade during vibration.

e. Float the surface as needed to produce a uniform surface. Before the concrete's initial set, tool the pavement edges and along each side of transverse isolation joints, formed joints, transverse construction joints, and fixed forms to produce a true-to-line ¼-inch radius with a smooth, dense mortar finish.

f. Remove forms after the pavement has cured sufficiently to avoid damaging the concrete. Remove individual forms sooner in order to saw transverse joints at the contractor's discretion.

B. Reinforcement

1. Keep reinforcement clean, free of rust and scale, and supported to prevent distortion.

2. Protect epoxy coated steel from cumulative exposure to sunlight for more the two (2) months by covering with an opaque material. Clear plastic shrink wrap for dowel bars and dowel baskets is sufficient protection for up to four (4) months exposure.

C. Jointing

1. General

a. Construct joints perpendicular to the pavement surface. Join new work to existing concrete pavement using tie bars or dowel bars epoxied into the existing pavement.

b. Saw joints in a single cut. Begin sawing as soon as the concrete hardens sufficiently to prevent excessive raveling along the saw cut and finish before conditions induce uncontrolled cracking.

c. CONTRACTOR may temporarily hand tool joints to reduce the potential for early cracking. Ensure hand-tooled joints have a ¼-inch radius and are smooth and straight. Saw hand-tooled joints as soon as practicable.

2. Longitudinal Joints

a. Construct parallel to the centerline along lane edges. On two-lane pavements, construct along the pavement centerline. On multi-lane pavements, construct along traffic and taper lane edges.

3. Transverse Joints

a. Extend transverse joints across the entire pavement width and through curb or median placed integrally with pavement. When the pavement abuts existing pavement, curb and gutter, or median, construct transverse joints matching existing joints or cracks.

b. Form a construction joint at the end of each day's run or when an interruption long enough for the concrete to develop its initial set occurs by doing one of the following:

1) Set a header board to support dowel bars. Use production quality concrete, hand vibrated behind the header board, and protect protruding bars from anything that might damage the bars or weaken the bond.

2) Saw back the concrete full depth to expose solid concrete then drill and epoxy in dowel bars.

D. Surface Finishing

1. Finish the pavement surface after excess moisture disappears and while it is still possible to produce a uniform striated surface texture.

2. Provide an artificial turf drag surface finish. Use a seamless strip of artificial turf approximately full pavement width and of sufficient length to provide approximately 2 feet of turf in contact with the pavement surface. Pull the drag with a device that allows control of the time and rate of texturing. Operate the drag in a longitudinal direction parallel with the centerline to produce a straight finish. Weight the drag as necessary to maintain contact with the pavement. Keep the drag clean and free of particles of hardened concrete.

3. Where it is impracticable to apply a turf finish, apply a broom finish.

4. Restore pavement texture damaged by rain by re-dragging the concrete while still plastic.

E. Curing of Concrete

1. After finishing operations and as soon as the free water disappears, spray the concrete surface with a uniform coating of curing compound. Seal moisture in the concrete by applying a continuous water-impermeable film on exposed concrete surfaces.

2. Apply curing compound with a self-propelled mechanical power sprayer whenever practicable. Hand-operated spraying equipment is acceptable for the following:

a. Irregular, narrow, or variable width sections.

b. Re-coating applications or after form removal.

c. Special applications approved by the OWNER.

3. Apply curing compound uniformly at a minimum rate of one gallon per 200 square feet.

4. If the curing compound coating is damaged within 72 hours after application, immediately recoat the affected area. If removing forms within 72 hours after placing concrete, coat newly exposed surfaces within 30 minutes after form removal.

F. Cold Weather Concreting

1. Suspend concreting operations if the descending air temperature in the shade and away from artificial heat falls below 35˚F. Do not resume concreting operations until the ascending air temperature in the shade and away from artificial heat reaches 30˚F. Maintain the concrete temperature at the point of placement at or above 50˚F.

2. If necessary to maintain placement temperature, heat the water, aggregates, or both.

3. Do not heat the cement, add salt or chemical admixtures to the concrete mix to prevent freezing.

4. If the national weather service forecast for the construction area predicts temperatures of less than 28°F within the next 24 hours, or when freezing temperatures actually occur, provide the following thermal protection to concrete that has not met the opening criteria:

Predicted or Actual Air Temp.	Min. Level of Protection
22 to <28°F	Single layer of polyethylene.
17 to <22°F	Double layer of polyethylene.
<17°F	6” of loose, dry straw or hay between 2 layers of polyethylene.

G. Sealing Joints

1. Seal all construction, longitudinal and transverse concrete pavement and concrete curb and gutter joints, including the joint between the pavement and the curb and gutter, and the transverse joints on curb and gutter to the face of the curb. Tool the sealant flush with or recessed up to a maximum of 1/16-inch ± 1/64-inch below the concrete surface. Overbonding is not allowed. Remove material remaining on the surface of the pavement without damaging the sealant in the joint.

3.3. FIELD QUALITY CONTROL

A. Air Entrainment

1. Test in accordance with AASHTO T152.

2. Perform daily air tests according to the following:

a. Perform a minimum of two tests per day, per mix design.

b. Submit daily air test results signed by the CONTRACTOR or his representative to the OWNER or his representative.

3. Acceptable air content:

a. Slip-formed concrete: 7.0 percent, +/- 1.5 percent

b. Other concrete: 6.0 percent, +/- 1.5 percent

B. Concrete Consistency / Slump

1. Perform consistency/slump tests according to the following:

a. A minimum of two tests per day, per mix design.

b. Sign the slump test results.

c. Submit daily slump test results to OWNER or representative.

2. Acceptable Slump:

a. 2.5-inches or less for slip-formed pavement.

b. 4-inches or less for non-slip-formed pavement.

C. Compressive Strength Testing

1. Test Procedure

a. Make and test concrete cylinders according to AASHTO T22 and T23.

b. Perform testing of concrete cylinders by an OWNER approved, independent, certified testing laboratory.

2. Testing Frequency

a. At a minimum, perform testing according to the following:

1) Once per day.

2) One test for each 150 cubic yards.

b. Make a minimum of three cylinders for each test.

c. For each test, record the station and location where the cylinders were made.

3. Compressive Strength Requirements

a. Test cylinders at 7 days and 28 days.

b. Prior to opening any new pavement to traffic, two cylinder tests must show a minimum of 3000 psi.

c. Obtain the OWNER'S approval prior to opening any new pavement to traffic.

D. Concrete Test Results

1. Submit all test results, from an OWNER approved certified testing laboratory, within 48 hours of test completion.

2. The test results should include at a minimum the following:

a. Compressive Strength of Concrete Cylinders or Compressive Strength of Concrete Cores

b. Slump

c. Air Entrainment

3. Send a copy of the test results to the concrete supplier, OWNER and ENGINEER.

END OF SECTION

SECTION 32 16 13.00

CONCRETE CURB & GUTTER

PART 1 – GENERAL

1.1. SUMMARY

A. Section Includes

1. Material requirements, reinforcement, joints, placement procedures, and testing procedures.

B. Measurement Procedures

1. Concrete Curb & Gutter

a. Measure curb or curb and gutter by the linear foot unless specified otherwise in the Contract Documents. Measure through drainage structures.

b. Measure curb or curb and gutter along either of the following:

1) Flow line of gutter.

2) Face of curb.

C. Payment Procedures

1. Concrete Curb & Gutter

a. Price includes:

1) Furnishing, installing, curing and protecting all materials incorporated into the work.

2) Saw cutting, jointing, sealing joints, reinforcement, preparation of the foundation, adjusting fixtures, testing, and required submittals.

2. Reinforcement

a. If a Bid Item exists, pay reinforcement according to the Specifications.

b. If no Bid Item exists, reinforcement is considered part of the concrete pavement. No additional compensation will be provided.

1.2. REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

1. C260 – Standard Specification for Air-Entraining Admixtures for Concrete

2. M31 – Standard Specification for Deformed and Plain Carbon and Low-Alloy Steel Bars for Concrete Reinforcement

3. M43 – Standard Specification for Sizes of Aggregate for Road and Bridge Construction

4. M153 – Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

5. M213 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

6. T11 – Standard Method of Test for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing

7. T19 – Standard Method of Test for Bulk Density ("Unit Weight") and Voids in Aggregates

8. T21 – Standard Method of Test for Organic Impurities in Fine Aggregates for Concrete

9. T22 – Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens

10. T23 – Standard Method of Test for Making and Curing Concrete Test Specimens in the Field

11. T27 – Standard Method of Test of Sieve Analysis of Fine and Coarse Aggregate

12. T71 – Standard Method of Test for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar

13. T84 – Standard Method of Test for Specific Gravity and Absorption of Fine Aggregate

14. T85 – Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate

15. T103 – Standard Method of Test for Soundness of Aggregates by Freezing and Thawing

16. T104 – Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

17. T113 – Standard Method of Test for Lightweight Particles in Aggregate

18. T152 – Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method

B. American Society for Testing and Materials (ASTM)

1. C150 – Standard Specification for Portland Cement

2. C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

3. C494 – Standard Specification for Chemical Admixtures for Concrete

4. C1260 – Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

5. C1567 – Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combination of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

6. D4791 – Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

7. D6690 – Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

1.3. SUBMITTALS

A. Manufacturer's Certifications

1. Submit the following a minimum of 10 days prior to incorporation into the work for review by the ENGINEER.

a. Certified test analysis for all elements of the Specifications both physical and chemical.

b. Certificate of compliance, by responsible company officer, stating all material furnished meets Contract Specifications.

B. Materials

1. Submit the following certifications a minimum of 10 days prior to incorporating a material into the work for review by the ENGINEER:

a. Portland Cement

1) A manufacturer’s written certification stating the source, amount, and composition of essential constituents and the composition of the final cement.

b. Reinforcement

1) A manufacturer's certified report of test or analysis showing the reinforcement conforms to the Specification.

c. Expansion Joint Filler

1) A manufacturer's written certification stating it conforms to AASHTO M153 or AASHTO M213.

d. Joint Sealer

1) A manufacturer's written certification stating it is a gray sealant complying with ASTM D6690 for non-sagging grade NS, Class 25, traffic area use T, and either single-component Type S, or multi-component Type M.

e. Concrete Curing Compounds

1) A manufacturer's written certification stating Poly-Alpha-Methylstyrene (PAM) liquid curing compound conforms to ASTM C309, Type 2, Class B.

f. Aggregates

1) Sampling and test results according to the following:

a)	Lightweight Pieces in Aggregate	AASHTO T113
b)	Material Finer than No. 200 Sieve	AASHTO T11
c)	Unit Weight of Aggregate	AASHTO T19
d)	Organic Impurities in Sands	AASHTO T21
e)	Sieve Analysis of Aggregates	AASHTO T27
f)	Effect of Organic Impurities in Fine Aggregate	AASHTO T71
g)	Alkali Silica Reactivity of Aggregates	ASTM C1260
h)	Alkali Silica Reactivity of Combinations of Cementitious Materials and Aggregates	ASTM C1567
i)	Freeze-Thaw Soundness of Coarse Aggregate (Procedure B, 16 Cycles, with Methyl Alcohol)	AASHTO T103
j)	Sodium Sulfate Soundness of Coarse Aggregated (R-4, 5 Cycles)	AASHTO T104

k) Specific Gravity and Absorption of Fine Aggregate AASHTO T84

l) Specific Gravity and Absorption of Coarse Aggregate AASHTO T85

m) Flat & Elongated Pieces Based on a 3:1 Ratio ASTM D4791

C. Mix Design

1. Submit a mix design a minimum of 10 days prior to incorporation into the work for review by the ENGINEER.

2. Submit the brand and source for each cement used on the project.

3. Include the following in the mix design:

a. Any necessary adjustments for the specific gravity of the aggregates used.

b. Any necessary adjustments to master limits of the job mix required by the Contract Specifications.

PART 2 – PRODUCTS

2.1. MATERIALS

A. Concrete

1. Concrete must consist of Portland cement, fine aggregate, coarse aggregate, and water proportioned and mixed according to the following:

a. Portland Cement

1) Type I Portland cement; ASTM C150.

2) Type II Portland cement: ASTM C150

3) Type III Portland cement: ASTM C150 for high early strength.

b. Air Entraining Admixtures

1) Conforms to AASHTO C260 for 7- and 28-day compressive and flexural strengths and resistance to freezing and thawing.

c. Retarding and Water Reducing Admixtures

1) Retarding admixtures must conform to ASTM C494, Type B.

2) Water reducing admixtures must conform to ASTM C494 Type A or D.

3) Do not add Type A and D admixtures to the same batch of concrete.

d. Water

1) Acceptable water

a) Drinking water from municipal water supplies.

b) From other sources meeting the following requirements:

(1) Acidity, maximum of 0.1N NaOH to neutralize 200mL of water: 2mL

(2) Alkalinity, maximum of 0.1N HCL to neutralize 200 mL of water: 15 mL

(3) Maximum sulphate (SO4): 0.05%

(4) Maximum chloride: 0.10%

(5) Maximum total solids:

(a) Organic: 0.04%

(b) Inorganic: 0.15%

c) If utilizing water from non-municipal water supply, test at least 2 quarts of water for conformance with the listed requirements.

e. Aggregates

1) Fine Aggregates

a) Consisting of a combination of sand with fine gravel, crushed gravel, or crushed stoned consisting of hard, strong, durable particles.

b) Do not exceed the following percentages of deleterious materials:

Substance	Percent by Weight
Material Passing the No. 200 Sieve	3.5
Coal	1.0
Clay Lumps	1.0
Shale	1.0

Substance	Percent by Weight
Other Deleterious Substances Like Alkali, Mica, Coated Grains, Soft and Flaky Particles	1.0

c) Do not exceed a total of 3.0% by weight of coal, clay lumps, shale, and other deleterious substances.

d) Acceptable gradation:

Sieve	Percent Passing by Weight
3/8-Inch	100
No. 4	90–100
No. 16	45–85
No. 50	5-30
No. 100	0-10

2) Coarse Aggregates

a) Consisting of clean, hard, durable gravel, crushed gravel, crushed stone, or crushed concrete free of an excess of flat and elongated pieces.

b) Do not exceed the following percentages of deleterious materials:

Substance	Percent by Weight
Material Passing the No. 200 Sieve	1.5
Coal	1.0
Clay Lumps	0.3
Soft Fragments	5.0
Shale	1.0
Flat & Elongated Pieces Based on a 3:1 Ratio	15
Lightweight Pieces (material having a saturated surface-dry bulk specific gravity of less than 2.45) (AASHTO T113)	5.0

c) Do not exceed a total of 5.0% by weight of coal, clay lumps, shale, and soft fragments.

d) Acceptable physical properties:

(1) Wear less than 50 or less.

(2) Soundness loss 12% or less.

(3) Freeze-thaw average loss 18% or less.

e) Acceptable gradations:

Sieve	Percent Passing by Weight AASHTO M43	
	Size No. 1 AASHTO No. 67	Size No. 2 AASHTO No. 4
2-Inch	-	100
1½-Inch	-	90-100
1-Inch	100	20-55
¾-Inch	90-100	0-15
3/8-Inch	20-55	0-5
No. 4	0-10	-
No. 8	0-5	-

f. Composition of Concrete

1) Conform to master limits in following chart:

Concrete Grade (2)(3)	Quantities for a Nominal Cubic Yard (1)						
	Cement (lb)	Class C Fly Ash (lb)	Slag (lb)	Weight Total Agg (lb)	Percent Fine Agg(4) (% total agg)	Design Water (gals)	Maximum Water (gals)
A	565	-	-	3120	30-40	27	32
A-FA (5)	395	170	-	3080	30-40	27	32
A-S (5)	395	-	170	3100	30-40	27	32
A-T (5)	395	Total fly ash and slag of 170 (6)		3090	30-40	27	32
C	660	-	-	2980	30-40	30	36
E	823	-	-	2810	50	32	35

(1) A nominal cubic yard has the tabulated weights of cement and aggregate, design mix water, and 6.0% air.

(2) For all grades, use a water-reducing admixture conforming to 501.2.3.3 and 501.3.2.4.4.

(3) For all grades, provide air entrainment as specified in 501.3.2.4.2.

(4) If using crushed stone or crushed concrete coarse aggregate, the ENGINEER may allow up to 45% fine aggregate.

(5) If using less than the tabulated maximum quantities of fly ash or slag, calculate the cement content by reducing the base cement content for the Grade A mix by the weight of fly ash or slag added.

(6) For ternary mixes containing cement, fly ash, and slag, if using less than the tabulated maximum combined quantity of fly ash and slag calculate the cement content by reducing the base cement content for the Grade A mix by the combined weight of fly ash and slag added.

2) Use concrete grade A unless specified otherwise in the Specifications.

g. High Early Strength Concrete

1) If high early strength concrete is required by the specifications or chosen by the CONTRACTOR it may be supplied with the following:

a) High early strength cement (Type III).

b) An additional amount of the same cement used in the original mix conforming to the Grade C or Grade E master limits.

2) There will be no additional compensation if CONTRACTOR chooses high early strength concrete.

B. Reinforcement

1. Provide epoxy coated reinforcement including reinforcing steel and tie bars conforming to AASHTO M31.

C. Expansion Joint Filler

1. Conforms to AASHTO M153 or AASHTO M213.

D. Joint Sealer

1. Conforms to ASTM D6690 Type II.

E. Concrete Curing Materials

1. Poly-Alpha-Methylstyrene (PAM) liquid curing compound conforming to ASTM C309, Type 2, Class B; polyethylene sheeting and burlap.

2.2. EQUIPMENT

A. Acceptable concrete mixing sources:

1. Automatic or Semi-Automatic Batch Plants

2. Ready-Mixed Concrete Plants

PART 3 – EXECUTION

3.1. PREPARATION

A. Preparation of Foundation

1. Includes, but is not limited to the following:

a. Repair unstable areas in the base course.

b. Place new base course in order to achieve curb and gutter ready condition.

2. Preparation of Aggregate Base Course

a. Scarify, shape, trim, and compact the surface of base aggregate where necessary to provide the required cross-sectional contour, a profile free from abrupt changes in elevations and a surface free from pits, hollows, depressions or projections above the normal surface.

b. Shape and trim the foundation to the plan required line, grade and cross section using long-wheel-base motor graders or sub-grade finishers designed for the purpose. Prepare foundation areas by hand or other methods approved by the ENGINEER if machine methods are impractical.

c. Prepare the foundation 1 foot wider on each side of the planned new curb and gutter width, or as shown on the plans.

d. Proof roll existing base aggregate using a loaded tandem axle truck. Remove and reconstruct areas showing appreciable displacement either laterally or longitudinally.

e. Moisten the foundation with water no less than 6 hours prior to placing the concrete. Provide moist but not saturated foundation at the time of placing concrete.

f. Prepare no less than 300 feet of foundation in advance of concrete placement operations unless approved by the ENGINEER.

B. Saw Cutting

1. Sawcut all curb and gutter to be removed, as shown on the Plans, or specified by the ENGINEER.

2. Perform saw cutting according to the following:

a. Place full depth saw cuts as indicated on the Plans.

b. Perform saw cutting so that the surface to remain is vertical for its full depth.

C. Adjust Catch Basins, Inlets, Manholes, and Valve Bowes

1. Adjust catch basins, inlets, manholes, valve boxes, and other fixtures to the plan grade and alignment.

2. Catch basin, inlet, and manhole adjustment includes the repair of the uppermost 12-inches of the existing masonry structure.

3.2. CONSTRUCTION

A. Placing Concrete Curb and Gutter

1. Use self-propelled slip-form paving equipment wherever possible.

2. Deposit, consolidate, and slip form the concrete to the required section. If not using a slip form process, deposit concrete in the forms, spade against the forms, and consolidate thoroughly. Use mechanical vibration for concrete with slump less than 2-inches. After consolidation strike off, and finish to the required section.

3. Unless constructed integrally with concrete pavement, securely anchor concrete curb, gutter, or curb & gutter, to adjoining concrete pavement by placing specified tie bars if and as the plans show.

4. Tie new work to existing concrete pavement using tie bars driven or epoxied into the existing concrete. Use only cast-in-place tie bars in construction joints between pavement and curb, gutter, or curb & gutter placed under the contract.

5. Form contraction joints by sawing or forming an induced plane of weakness at least 2-inches deep in the curb, gutter, or curb & gutter directly opposite construction or contraction joints in adjoining concrete pavement and at the required spacing when adjoining asphaltic pavement. Space all joints between 6 feet and approximately 20 feet apart.

6. Saw as soon as possible after the concrete sets sufficiently to prevent raveling during sawing, and before shrinkage cracking takes place. If this method results in random cracking, then form an induced plane of weakness.

7. Construct depressions in or revisions of the curb, in curb, or curb & gutter to accommodate curb ramps and driveways at locations and as shown on the plans.

B. Finishing

1. Float and brush the face surfaces of the curb or curb and gutter. Round the back edge of curbs, the edge of the gutter next to the pavement, and edges next to expansion joints or induced contraction joints, with a ¼-inch radius edger.

C. Expansion Joints

1. Place expansion joints at the following locations:

a. Where tangent and radial curb & gutter meet.

b. On each side of every inlet 3 feet from the inlet but no closer than 6 feet from another joint.

c. Between 6 feet and 300 feet apart on tangent sections.

d. Matching expansion joints in adjacent concrete pavement.

2. Set joints at right angles to the face of curb and at right angles to the flow line and surface of gutters.

3. Use ¾-inch wide joint filler.

D. Curing of Concrete

1. After finishing operations and as soon as the free water disappears, spray the concrete surface with a uniform coating of curing compound. Seal moisture in the concrete by applying a continuous water-impermeable film on exposed concrete surfaces.

2. Apply curing compound with a self-propelled mechanical power sprayer whenever practicable. Hand-operated spraying equipment is acceptable for the following:

   a. Irregular, narrow, or variable width sections.

   b. Re-coating applications or after form removal.

   c. Special applications approved by the OWNER.

3. Apply curing compound uniformly at a minimum rate of one gallon per 200 square feet.

4. If the curing compound coating is damaged within 72 hours after application, immediately recoat the affected area. If removing forms within 72 hours after placing concrete, coat newly exposed surfaces within 30 minutes after form removal.

E. Cold Weather Concreting

1. Suspend concreting operations if the descending air temperature in the shade and away from artificial heat falls below 35˚F. Do not resume concreting operations until the ascending air temperature in the shade and away from artificial heat reaches 30˚F. Maintain the concrete temperature at the point of placement at or above 50˚F.

2. If necessary to maintain placement temperature, heat the water, aggregates, or both.

3. Do not heat the cement, add salt or chemical admixtures to the concrete mix to prevent freezing.

4. If the national weather service forecast for the construction area predicts temperatures of less than 28°F within the next 24 hours, or when freezing temperatures actually occur, provide the following thermal protection to concrete that has not met the opening criteria:

Predicted or Actual Air Temp.	Min. Level of Protection
22 to <28°F	Single layer of polyethylene.
17 to <22°F	Double layer of polyethylene.
<17°F	6" of loose, dry straw or hay between 2 layers of polyethylene.

F. Sealing Joints

1. If adjacent or integral to sealed concrete pavement, seal all concrete curb and gutter joints, including the joint between the concrete pavement and the curb and gutter, and the transverse joints on curb and gutter to the face of the curb. Tool the sealant flush with or recessed up to a maximum of 1/16-inch ± 1/64-inch below the concrete surface. Overbonding will not be allowed. Remove material remaining on the surface of the pavement without damaging the sealant in the joint.

3.3. FIELD QUALITY CONTROL

A. Air Entrainment

1. Test in accordance with AASHTO T152.

2. Perform daily air tests according to the following:

a. Perform a minimum of two tests per day, per mix design.

b. Submit daily air test results signed by the CONTRACTOR or his representative to the OWNER or his representative.

3. Acceptable air content:

a. Slip-formed concrete: 7.0 percent, +/- 1.5 percent

b. Other concrete: 6.0 percent, +/- 1.5 percent

B. Concrete Consistency / Slump

1. Perform consistency/slump tests according to the following:

a. A minimum of two tests per day, per mix design.

b. Sign the slump test results.

c. Submit daily slump test results to OWNER or representative.

2. Acceptable Slump

a. 2.5-inches or less for slip-formed pavement.

b. 4-inches or less for non-slip-formed pavement.

C. Compressive Strength Testing

1. Test Procedure

a. Make and test concrete cylinders according to AASHTO T22 and T23.

b. Perform testing of concrete cylinders by an OWNER approved, independent, certified testing laboratory.

2. Testing Frequency

a. At a minimum, perform testing according to the following:

1) Once per day.

2) One test for each 150 cubic yards.

b. Make a minimum of three cylinders for each test.

c. For each test, record the station and location where the cylinders were made.

3. Compressive Strength Requirements

a. Test cylinders at 7 days and 28 days.

b. Prior to opening any new curb & gutter to traffic, two cylinder tests must show a minimum of 3000 psi.

c. Obtain the OWNER'S approval prior to opening any new pavement to traffic.

D. Concrete Test Results

1. Submit all test results, from an OWNER approved certified testing laboratory, within 48 hours of test completion.

2. The test results should include at a minimum the following:

a. Compressive Strength of Concrete Cylinders or Compressive Strength of Concrete Cores

b. Slump

c. Air Entrainment

3. Send a copy of the test results to the concrete supplier, OWNER and ENGINEER.

END OF SECTION

SECTION 32 16 23.00

CONCRETE SIDEWALK & DRIVEWAYS

PART 1 – GENERAL

1.1. SECTION INCLUDES

A. Material requirements, reinforcement, joints, placement procedures, and testing procedures.

1.2. MEASUREMENT PROCEDURES

A. Concrete Sidewalk & Driveway

1. Measure 6-inch concrete sidewalk, including handicap ramps and driveways, by the square foot unless specified otherwise in the Contract Documents.

2. Measure 4-inch concrete sidewalk by the square foot unless specified otherwise in the Contract Documents.

1.3. PAYMENT PROCEDURES

A. Concrete Sidewalk & Driveway

1. Price includes:

a. Furnishing, installing, curing and protecting all materials incorporated into the work.

b. Saw cutting, jointing, sealing joints, reinforcement, preparation of the foundation, adjusting fixtures, testing, and required submittals.

B. Reinforcement

1. If a Bid Item exists, pay reinforcement according to the Specifications.

2. If no Bid Item exists, reinforcement is considered part of the concrete sidewalk or driveway. No additional compensation will be provided.

C. Pay for 6-inch concrete sidewalk, including handicap ramps and driveways, by the square foot unless specified otherwise in the Contract Documents.

D. Pay for 4-inch concrete sidewalk by the square foot unless specified otherwise in the Contract Documents.

1.4. REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

1. C260 – Standard Specification for Air-Entraining Admixtures for Concrete

2. M31 – Standard Specification for Deformed and Plain Carbon and Low-Alloy Steel Bars for Concrete Reinforcement

3. M43 – Standard Specification for Sizes of Aggregate for Road and Bridge Construction

4. M153 – Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

5. M213 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

6. T11 – Standard Method of Test for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing

7. T19 – Standard Method of Test for Bulk Density ("Unit Weight") and Voids in Aggregates

8. T21 – Standard Method of Test for Organic Impurities in Fine Aggregates for Concrete

9. T22 – Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens

10. T23 – Standard Method of Test for Making and Curing Concrete Test Specimens in the Field

11. T27 – Standard Method of Test of Sieve Analysis of Fine and Coarse Aggregate

12. T71 – Standard Method of Test for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar

13. T84 – Standard Method of Test for Specific Gravity and Absorption of Fine Aggregate

14. T85 – Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate

15. T103 – Standard Method of Test for Soundness of Aggregates by Freezing and Thawing

16. T104 – Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

17. T113 – Standard Method of Test for Lightweight Particles in Aggregate

18. T152 – Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method

B. American Society for Testing and Materials (ASTM)

1. C150 – Standard Specification for Portland Cement

2. C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

3. C494 – Standard Specification for Chemical Admixtures for Concrete

4. C1260 – Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

5. C1567 – Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combination of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

6. D4791 – Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

1.5. SUBMITTALS

A. Manufacturer's Certifications

1. Submit the following a minimum of 10 days prior to incorporation into the work for review by the ENGINEER.

a. Certified test analysis for all elements of the Specifications both physical and chemical.

b. Certificate of compliance, by responsible company officer, stating all material furnished meets Contract Specifications.

B. Materials

1. Submit the following certifications a minimum of 10 days prior to incorporating a material into the work for review by the ENGINEER:

a. Portland Cement

1) A manufacturer’s written certification stating the source, amount, and composition of essential constituents and the composition of the final cement.

b. Reinforcement

1) A manufacturer’s certified report of test or analysis showing the reinforcement conforms to the specification.

c. Expansion Joint Filler

1) A manufacturer's written certification stating it conforms to AASHTO M153 or AASHTO M213.

d. Concrete Curing Compounds

1) A manufacturer's written certification stating Poly-Alpha-Methylstyrene (PAM) liquid curing compound conforms to ASTM C309, Type 2, Class B.

e. Aggregates

1) Sampling and test results according to the following:

a)	Lightweight Pieces in Aggregate	AASHTO T113
b)	Material Finer than No. 200 Sieve	AASHTO T11
c)	Unit Weight of Aggregate	AASHTO T19
d)	Organic Impurities in Sands	AASHTO T21
e)	Sieve Analysis of Aggregates	AASHTO T27
f)	Effect of Organic Impurities in Fine Aggregate	AASHTO T71
g)	Alkali Silica Reactivity of Aggregates	ASTM C1260
h)	Alkali Silica Reactivity of Combinations of Cementitious Materials and Aggregates	ASTM C1567
i)	Freeze-Thaw Soundness of Coarse Aggregate (Procedure B, 16 Cycles, with Methyl Alcohol)	AASHTO T103
j)	Sodium Sulfate Soundness of Coarse Aggregated (R-4, 5 Cycles)	AASHTO T104
k)	Specific Gravity and Absorption of Fine Aggregate	AASHTO T84
l)	Specific Gravity and Absorption of Coarse Aggregate	AASHTO T85
m)	Flat & Elongated Pieces Based on a 3:1 Ratio	ASTM D4791

C. Mix Design

1. Submit a mix design a minimum of 10 days prior to incorporation into the work for review by the ENGINEER.

2. Submit the brand and source for each cement used on the project.

3. Include the following in the mix design:

a. Any necessary adjustments for the specific gravity of the aggregates used.

b. Any necessary adjustments to master limits of the job mix required by the Contract Specifications.

PART 2 – PRODUCTS

2.1. MATERIALS

A. Concrete

1. Concrete must consist of Portland cement, fine aggregate, coarse aggregate, and water proportioned and mixed according to the following:

a. Portland Cement

1) Type I Portland cement; ASTM C150.

2) Type II Portland cement: ASTM C150

3) Type III Portland cement: ASTM C150 for high early strength.

b. Air Entraining Admixtures

1) Conforms to AASHTO C260 for 7- and 28-day compressive and flexural strengths and resistance to freezing and thawing.

c. Retarding and Water Reducing Admixtures

1) Retarding admixtures must conform to ASTM C494, Type B.

2) Water reducing admixtures must conform to ASTM C494, Type A or D.

3) Do not add Type A and D admixtures to the same batch of concrete.

d. Water

1) Acceptable Water

a) Drinking water from municipal water supplies.

b) From other sources meeting the following requirements:

(1) Acidity, maximum of 0.1N NaOH to neutralize 200mL of water: 2mL
(2) Alkalinity, maximum of 0.1N HCL to neutralize 200 mL of water: 15 mL
(3) Maximum sulphate (SO4): 0.05%
(4) Maximum chloride: 0.10%
(5) Maximum total solids:
(a) Organic: 0.04%
(b) Inorganic: 0.15%

c) If utilizing water from non-municipal water supply, test at least 2 quarts of water for conformance with the listed requirements.

e. Aggregates

1) Fine Aggregates

a) Consisting of a combination of sand with fine gravel, crushed gravel, or crushed stoned consisting of hard, strong, durable particles.

b) Do not exceed the following percentages of deleterious materials:

Substance	Percent by Weight
Material Passing the No. 200 Sieve	3.5
Coal	1.0
Clay Lumps	1.0
Shale	1.0
Other Deleterious Substances Like Alkali, Mica, Coated Grains, Soft and Flaky Particles	1.0

c) Do not exceed a total of 3.0% by weight of coal, clay lumps, shale, and other deleterious substances.

d) Acceptable Gradation:

Sieve	Percent Passing by Weight
3/8 Inch	100
No. 4	90-100
No. 16	45-85
No. 50	5-30
No. 100	0-10

2) Coarse Aggregates

a) Consisting of clean, hard, durable gravel, crushed gravel, crushed stone, or crushed concrete free of an excess of flat and elongated pieces.

b) Do not exceed the following percentages of deleterious materials:

Substance	Percent by Weight
Material Passing the No. 200 Sieve	1.5
Coal	1.0
Clay Lumps	0.3
Soft Fragments	5.0
Shale	1.0
Flat & Elongated Pieces Based on a 3:1 Ratio	15
Lightweight Pieces (Material having a saturated surface-dry bulk specific gravity of less than 2.45) (AASHTO T113)	5.0

c) Do not exceed a total of 5.0% by weight of coal, clay lumps, shale, and soft fragments.

d) Acceptable Physical Properties:

(1) Wear less than 50 or less.
(2) Soundness loss 12% or less.
(3) Freeze-thaw average loss 18% or less.

e) Acceptable Gradations:

Sieve	Percent Passing by Weight	
	Size No. 1 AASHTO No. 67	Size No. 2 AASHTO No. 4
2 Inch	-	100
1½ Inch	-	90-100
1 Inch	100	20-55

Sieve	Percent Passing by Weight	
	Size No. 1 AASHTO No. 67	Size No. 2 AASHTO No. 4
¾ Inch	90-100	0-15
3/8 Inch	20-55	0-5
No. 4	0-10	-
No. 8	0-5	-

f) Composition of Concrete

(1) Conform to master limits in following chart:

Concrete Grade (2)(3)	Quantities for a Nominal Cubic Yard (1)						
	Cement (lb)	Class C Fly Ash (lb)	Slag (lb)	Weight Total Agg (lb)	Percent Fine Agg(4) (% total agg)	Design Water (gals)	Maximum Water (gals)
A	565	-	-	3120	30-40	27	32
A-FA (5)	395	170	-	3080	30-40	27	32
A-S (5)	395	-	170	3100	30-40	27	32
A-T (5)	395	Total fly ash and slag of 170 (6)		3090	30-40	27	32
C	660	-	-	2980	30-40	30	36
E	823	-	-	2810	50	32	35

(1) A nominal cubic yard has the tabulated weights of cement and aggregate, design mix water, and 6.0% air.
(2) For all grades, use a water-reducing admixture conforming to 501.2.3.3 and 501.3.2.4.4.
(3) For all grades, provide air entrainment as specified in 501.3.2.4.2.
(4) If using crushed stone or crushed concrete coarse aggregate, the ENGINEER may allow up to 45% fine aggregate.
(5) If using less than the tabulated maximum quantities of fly ash or slag, calculate the cement content by reducing the base cement content for the Grade A mix by the weight of fly ash or slag added.
(6) For ternary mixes containing cement, fly ash, and slag, if using less than the tabulated maximum combined quantity of fly ash and slag calculate the cement content by reducing the base cement content for the Grade A mix by the combined weight of fly ash and slag added.

(2) Use concrete grade A unless specified otherwise in the specifications.

g) High Early Strength Concrete

(1) If high early strength concrete is required by the specifications or chosen by the CONTRACTOR it may be supplied with the following:

(a) High early strength cement (Type III).
(b) An additional amount of the same cement used in the original mix conforming to the Grade C or Grade E master limits.

(2) There will be no additional compensation if CONTRACTOR chooses high early strength concrete.

B. Reinforcement

1. Provide epoxy coated reinforcement including reinforcing steel and tie bars conforming to AASHTO M31 if required in the Contract.

C. Expansion Joint Filler

1. Conforms to AASHTO M153 or AASHTO M213.

D. Concrete Curing Materials

1. Poly-Alpha-Methylstyrene (PAM) liquid curing compound conforming to ASTM C309, Type 2, Class B; polyethylene sheeting and burlap.

2.2. EQUIPMENT

A. Acceptable Concrete Mixing Sources

1. Automatic or Semi-Automatic Batch Plants.

2. Ready-Mixed Concrete Plants.

PART 3 – EXECUTION

3.1. PREPARATION

A. Preparation of Foundation

1. Includes, but is not limited to the following:

a. Repair unstable areas in the base course.

b. Place new base course in order to achieve concrete driveway or sidewalk ready condition.

2. Preparation of Aggregate Base Course

a. Tamp or compact the base aggregate to ensure stability.

b. Construct the sidewalk or driveway foundation at least 1 foot wider on each side than the proposed sidewalk. Construct sidewalks on a 4-inch layer of compacted aggregate base course and driveways on a 6-inch layer of compacted aggregate base course unless otherwise shown in the Contract Documents.

B. Saw Cutting

1. Sawcut all driveway or sidewalk to be removed, as shown on the Plans, or specified by the ENGINEER.

2. Perform saw cutting according to the following:

a. Place full depth saw cuts as indicated on the Plans.

b. Perform saw cutting so that the surface to remain is vertical for its full depth.

C. Adjust Catch Basins, Inlets, Manholes, and Valve Boxes

1. Adjust catch basins, inlets, manholes, valve boxes, and other fixtures to the plan grade and alignment.

2. Catch basin, inlet, and manhole adjustment includes the repair of the uppermost 12-inches of the existing masonry structure.

3.2. CONSTRUCTION

A. Placing Concrete Sidewalk and Driveway

1. Place the concrete on a moist foundation and consolidate sufficiently to bring the mortar to the surface, then strike-off and finish to a true and even surface. Brush or lightly broom the surface before the mortar sets.

2. Embed detectable warning field array in plastic concrete in curb ramps.

3. Tie new driveway to existing concrete driveway using tie bars driven or epoxied into the existing driveway if required in the contract.

B. Finishing

1. Brush or lightly broom the sidewalk or driveway surface before the mortar sets.

2. Round the edge along forms and unsawed joints with a 1/2-inch radius edger.

C. Reinforcement

1. If required, use reinforcement conforming to, and place it as specified on, the plans.

D. Joints

1. Expansion Joints

a. Place expansion joints at the following locations:

1) Between sidewalk or driveway and back of curb & gutter.

2) No greater than 96 feet apart on tangent sections.

3) Matching expansion joints in adjacent concrete pavement.

b. Set joints at right angles to the edge of sidewalk or driveway.

c. Use 1/2-inch wide joint filler.

2. Longitudinal and Transverse Joints

a. Form contraction joints by sawing or forming an induced plane of weakness at least 1-inch deep and ¼-inch wide in the sidewalk or driveway directly opposite construction or contraction joints in adjoining concrete and at the required spacing when adjoining asphaltic pavement. Space all joints between 3 feet and approximately 12 feet apart.

b. Saw as soon as possible after the concrete sets sufficiently to prevent raveling during sawing, and before shrinkage cracking takes place. If this method results in random cracking, then form an induced plane of weakness.

c. Construct longitudinal joints parallel to the centerline.

d. Construct transverse joints at right angles to the sidewalk or driveway centerline.

e. Construct longitudinal joints and transverse joints at right angles to each other.

E. Curing of Concrete

1. After finishing operations and as soon as the free water disappears, spray the concrete surface with a uniform coating of curing compound. Seal moisture in the concrete by applying a continuous water-impermeable film on exposed concrete surfaces.

2. Apply curing compound with a self-propelled mechanical power sprayer whenever practicable. Hand-operated spraying equipment is acceptable for the following:

a. Irregular, narrow, or variable width sections.

b. Re-coating applications or after form removal.

c. Special applications approved by the OWNER.

3. Apply curing compound uniformly at a minimum rate of one gallon per 200 square feet.

4. If the curing compound coating is damaged within 72 hours after application, immediately recoat the affected area. If removing forms within 72 hours after placing concrete, coat newly exposed surfaces within 30 minutes after form removal.

F. Cold Weather Concreting

1. Suspend concreting operations if the descending air temperature in the shade and away from artificial heat falls below 35˚F. Do not resume concreting operations until the ascending air temperature in the shade and away from artificial heat reaches 30˚F. Maintain the concrete temperature at the point of placement at or above 50˚F.

2. If necessary, to maintain placement temperature, heat the water, aggregates, or both.

3. Do not heat the cement, add salt or chemical admixtures to the concrete mix to prevent freezing.

4. If the national weather service forecast for the construction area predicts temperatures of less than 28°F within the next 24 hours, or when freezing temperatures actually occur, provide the following thermal protection to concrete that has not met the opening criteria:

Predicted or Actual Air Temp.	Min. Level of Protection
22 to <28°F	Single layer of polyethylene.
17 to <22°F	Double layer of polyethylene.
<17°F	6” of loose, dry straw or hay between two layers of polyethylene.

3.3. FIELD QUALITY CONTROL

A. Air Entrainment

1. Test in accordance with AASHTO T152.

2. Perform daily air tests according to the following:

a. Perform a minimum of two tests per day, per mix design.

b. Submit daily air test results signed by the CONTRACTOR or his representative to the OWNER or his representative.

3. Acceptable air content:

a. 6.0 percent, +/- 1.5 percent

B. Concrete Consistency / Slump

1. Perform consistency/slump tests according to the following:

a. A minimum of two tests per day, per mix design.

b. Sign the slump test results.

c. Submit daily slump test results to OWNER or representative.

2. Acceptable Slump:

a. 2.5-inches or less for slip-formed pavement.

b. 4-inches or less for non-slip-formed pavement.

C. Compressive Strength Testing

1. Test Procedure

a. Make and test concrete cylinders according to AASHTO T22 and T23.

b. Perform testing of concrete cylinders by an OWNER approved, independent, certified testing laboratory.

2. Testing Frequency

a. At a minimum, perform testing according to the following:

1) Once per day.

2) One test for each 150 cubic yards.

b. Make a minimum of three cylinders for each test.

c. For each test, record the station and location where the cylinders were made.

3. Compressive Strength Requirements

a. Test cylinders at 7 days and 28 days.

b. Prior to opening any new driveway to traffic, two cylinder tests must show a minimum of 3000 psi.

c. Obtain the OWNER'S approval prior to opening any new sidewalk or driveway to traffic.

D. Concrete Test Results

1. Submit all test results, from an OWNER approved certified testing laboratory, within 48 hours of test completion.

2. The test results should include at a minimum the following:

a. Compressive Strength of Concrete Cylinders or Compressive Strength of Concrete Cores

b. Slump

c. Air Entrainment

3. Send a copy of the test results to the concrete supplier, OWNER and ENGINEER.

END OF SECTION

SECTION 32 17 23.00

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1. SECTION INCLUDES

A. Providing, installing, and removing pavement marking.

1.2. MEASUREMENT PROCEDURES

A. Measure marking line, stop line, dotted extension, diagonal, chevron, crosswalk, curb, parking stall, and removing marking lines by material and size by the lineal foot.

B. Measure marking arrows, words, symbols, railroad crossing, yield line, and island nose on an each basis.

C. Measure marking corrugated median by the square foot.

D. Include RXR symbol and 3 transverse lines as one railroad crossing.

E. Measure curb with vertical face and top of curb being one unit per lineal foot.

F. Measure yield line as each individual triangle in the yield line.

1.3. PAYMENT PROCEDURES

A. Pay for marking line, stop line, dotted extension, diagonal, chevron, crosswalk, curb, parking stall, and removing marking lines by material and size by the lineal foot.

B. Pay for marking arrows, words, symbols, railroad crossing, and island nose on an each basis.

C. Pay for marking corrugated median on a square foot basis.

1.4. REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

1. M247 – Standard Specification for Glass Beads Used in Pavement Marking

B. ASTM International (ASTM)

1. D6628 – Standard Specification for Color of Pavement Marking Materials

1.5. QUALITY ASSURANCE / CONTROL SUBMITTALS

A. Submit Certificate of Conformance signed by authorized agent of the manufacturer or supplier.

B. Submit manufacturer specifications.

1.6. CLOSEOUT SUBMITTALS

A. Provide record drawing showing installed items and quantities.

PART 2 - PRODUCTS

2.1. MATERIALS

A. Glass Beads

1. Dual coated glass beads treated for both moisture resistance and adherence conforming to AASHTO M247, Type 1, except with a minimum of 80 percent true spheres.

2. Furnish beads in containers or bags labeled with the bead type, net weight, lot or batch number, blend date, and manufacturer's name and address.

PART 3 - EXECUTION

3.1. INSTALLATION

A. General

1. Prepare surface and apply marking as the manufacturer specifies.

B. Liquid Marking

1. Apply marking to the width and color the bid item indicates. Provide a sharp cutoff for both sides and ends of the marking with a uniform cross-section.

2. If roadway is open to traffic use temporary raised pavement markers. Apply permanent marking within 7 days of completing mainline paving. If the roadway is closed during construction, apply permanent marking before opening to traffic.

3. Protect freshly applied marking until the line is dry or cured enough to prevent pickup under traffic. Place traffic cones on wet lines immediately behind the marking train or use a convoy of moving vehicles to keep traffic from crossing the wet line. Remove cones promptly after the line dries or cures.

4. Apply liquid marking and glass beads to or exceeding the following:

LIQUID MARKING PAINT	PAVEMENT TYPE	THICKNESS (mils)	BEAD APPLICATION (pounds per gallon)
Paint	All	16	8
Epoxy	Seal Coat	25	25
Epoxy	All Other	20	22.5

C. Long Line Marking

1. Long lines are centerlines, lane lines, edge lines, channelizing lines, and dotted extension lines.

2. Equipment

a. Use equipment that can spray both yellow and white material to produce uniform lines. Ensure the equipment can do the following:

1) Applies lines both on the left and right sides, not necessarily simultaneously.

2) Applies two (2) lines simultaneously, with either line in a solid or intermittent pattern, in yellow or white.

3) Reports a daily-accumulated installed length for each gun.

4) Reports a volume of paint used each day.

b. Use automatic, mechanical devices to apply glass beads and report the volume used.

D. Cold Weather Marking

1. Do not place permanent paint if the ambient or pavement temperature is below 50°F.

2. Do not place epoxy marking if the ambient or pavement temperature is below 35°F unless the ENGINEER allows in writing.

E. Removing Marking

1. Remove marking by air blasting, water blasting, or grinding. Provide a dust control system and remove accumulated sand or other materials. Collect, haul, and dispose of dust or residue from removals.

2. Perform air blasting conforming to the following:

a. If air blasting within 10 feet of a lane open to traffic, remove dust and other residue continuously while blast cleaning.

b. If removing existing marking before applying new marking, expose at least 90 percent of the marking surface.

c. If removing yellow centerline for no passing zone changes, ensure the cycling mechanism on line removal equipment produces a uniform cycle or alternatively remove by hand.

3. Perform water blasting only if the ambient temperature is at least 36°F and rising. Use a truck mounted ultra-high pressure pump and water tank capable of delivering between 30,000 psi and 40,000 psi to water jet nozzles. Provide a vacuum recovery system that contains wastewater and debris to provide a clean, damp-dry surface without a secondary cleanup operation.

4. Grind using a truck-mounted or hand system capable of complete removal of the marking. Provide a vacuum system to completely collect dust and debris.

3.2. TRAFFIC CONTROL

A. On roadways open to 2-way traffic, provide a leading vehicle and a trailing vehicle equipped with the following:

1. A slow-moving vehicle emblem.

2. One or more flashing or revolving yellow lights showing to the front and rear.

3. Signs to advise traffic of the wet line and number of vehicles in the marking train.

B. On one-way roadways, operate marking train vehicles in the direction of traffic. Provide the following:

1. A minimum of two (2) trailing vehicles. A leading vehicle is not required.

2. A slow-moving vehicle emblem.

3. One or more flashing or revolving yellow lights showing to the front and rear.

4. May use flashing arrow panels to direct traffic to pass.

3.3. REPAIR

A. Repair or replace marking the ENGINEER deems improperly constructed.

3.4. FIELD QUALITY CONTROL

A. If ENGINEER or OWNER request, provide calculations demonstrating that the application rate is consistent with the specified dimensions and the bead application rate is consistent with the specified rate. If on any block-long section or individual special marking have a calculated application rate less than 90 percent of that specified, remove and remark this section or special marking.

END OF SECTION

SECTION 32 19 00.00

PAVEMENT REPAIR & RESURFACING

PART 1 - GENERAL

1.1. DESCRIPTION

A. Wherever any paved or graveled surface (including curb and gutter and sidewalk) has been damaged or removed by the CONTRACTOR, replace or repair existing improvements at the CONTRACTOR's expense. Replace with the same material, thickness and type as the existing disturbed surface

B. The OWNER will perform repairs or replacements if the CONTRACTOR is negligent in completing the repairs in a reasonable time period. The OWNER may deduct the cost for such work from the monies due the CONTRACTOR.

C. Repair disturbed areas as specified herein or in accordance with other sections of the Specification.

D. Maintain barricades, guard rails, signs and warning devices to provide traffic control during the construction period and during repairs to paved areas. Provide dust control during this same period, seeing that the areas are oiled, watered, or treated with calcium chloride.

1.2. RELATED SECTIONS

A. Section 31 20 00.00 Earthwork

B. Section 32 11 23.00 Base Aggregates

C. Section 32 12 16.00 Asphaltic Concrete Paving

D. Section 32 13 13.00 Concrete Pavements

E. Section 32 16 13.00 Concrete Curb & Gutter

F. Section 32 16 23.00 Concrete Sidewalk & Driveways

G. Section 33 05 22.00 Utility Trenching and Backfilling

1.3. REGULATORY REQUIREMENTS

A. Contact State and County Highway Departments before preparing the bid to determine their requirements.

PART 2 - PRODUCTS

2.1. GENERAL

A. Meet requirements of Section 32 11 23.00 Base Aggregates.

B. Meet requirements of Section 32 12 16.00 Asphaltic Concrete Paving.

C. Meet requirements of Section 32 13 13.00 Concrete Pavements.

D. Meet requirements of Section 32 16 13.00 Concrete Curb and Gutter.

E. Meet requirements of Section 32 15 23.00 Concrete Sidewalk and Driveways.

PART 3 - EXECUTION

3.1. GENERAL

A. Compact backfill material in accordance with the requirements of Section 33 05 22.00 – Utility Trenching and Backfilling and/or Section 31 20 00.00 – Earthwork.

B. Remove the materials placed to the depth required for the pavement specified. Sawcut the adjoining pavement edges to provide neatly trimmed edges clean of any shattered or split material. Compact sub-grade with suitable equipment.

3.2. CONCRETE PAVEMENTS

A. Provide an aggregate base a minimum of 6-inches thick.

B. Replace concrete pavement to the same thickness as the adjoining slab. Provide a minimum thickness of 6-inches.

C. Saw pavement using a diamond saw to make straight, full depth cuts without causing further cracking of the surrounding pavement. Remove the spalled concrete with a light hammer.

D. Install tie bars in all the replaced concrete pavement. Drill tie bars in accordance with Wisconsin Department of Transportation (DOT) design. Install number 6x12-inch deformed bars spaced at 3 feet on longitudinal joints and 1 foot on transverse joints.

E. Perform work in accordance with the requirements of Section 32 13 13.00 - Concrete Pavements.

3.3. ASPHALT PAVEMENT & ASPHALT DRIVEWAYS

A. Replace asphalt pavement to the same thickness as adjoining pavement. Place a minimum thickness of 3-inches asphalt pavement over a 12-inch aggregate base.

B. Place asphalt with a paving machine if the trench width exceeds 4 feet.

C. Perform work in accordance with the requirements of Section 32 12 16.00 - Asphaltic Concrete Paving.

3.4. GRAVEL SURFACES

A. Replace gravel roadway or walkway surface with a cross section conforming to the adjacent base course or a minimum of 12-inches of Base Aggregate in accordance with Section 32 11 23.00 – Base Aggregates.

3.5. CONCRETE SURFACES

A. Concrete Curb & Gutter

1. Replace curb and gutter with curb and gutter having a cross section conforming to the adjacent curbing. Perform work in accordance with the requirements of Section 32 16 13.00 - Concrete Curb & Gutter.

B. Sidewalks & Driveways

1. Replace sidewalks and driveways with the same thickness and width to conform to adjacent walks and driveways. Perform work in accordance with the requirements of Section 32 16 23.00 - Concrete Sidewalk & Driveways.

3.6. TEMPORARY RESURFACING & MAINTENANCE

A. If site conditions (such as cold weather) preclude placing the permanent pavement replacement, the OWNER may instruct the CONTRACTOR to place temporary asphalt cold mix patches in open excavation or place asphalt around manhole castings to prevent damage by snow plows.

B. The OWNER may deduct the cost for any maintenance or emergency repair work provided by the OWNER in areas that have not yet been paved from the monies due the CONTRACTOR.

3.7. REQUIREMENTS BY OTHERS

A. Repair streets, highways, alleys, highway shoulders, ditches or other surfaces that occur on County or State Highways or property in accordance with the County or State Highway Departments. Acquire County or State Highway Department approval before the work will be accepted by the OWNER. When special backfill is required by the County or State Highway Departments, include the cost of hauling away the surplus material removed from the trench and the cost of furnishing, hauling and placing special backfill in the unit price bid for the items in which such backfill is required.

END OF SECTION

SECTION 32 92 00.00

LANDSCAPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Restoration, seed, fertilizer, mulch, sod, trees, shrubs, biofiltration prairie plants, prairie seed, and wetland plants.

1.2 MEASUREMENT PROCEDURES

A. The OWNER reserves the right to modify the landscaping limits during construction. Payment will be based on the final quantity and unit price bid for each bid item.

1.3 REFERENCES

A. Conform to the Standard Specifications for Road and Bridge Construction of the State of Wisconsin, Current Edition, in addition to the requirements of this section.

1.4 DEFINITIONS

A. Restoration include the items of topsoil, seed, fertilizer and mulch, unless otherwise noted.

B. 'Catch' or Uniform Stand: Germination/sprouting of seed resulting in plants of mature height and density. For seed mixture in Table 32 92 00.00-1 80% density is required.

C. Deconsolidation: Loosening or decreasing density of soil by mechanical methods.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Friable soil, obtained from natural, well-drained areas.

B. Free from refuse, heavy weeds or grasses.

C. Free from heavy roots, clay lumps, stones larger than 1-inch in size, sticks, brush, litter and other deleterious substances.

D. Maximum 5% by volume of the following: Stones smaller than 1-inch, coarse sand and small clay lumps.

E. Free from insoluble carbonates and conform to the following requirements (verified by soil analysis):

1. Between 1% and 13% organic matter, as determined by the test for organic matter in accordance with ASTM D2974.

2. Between 12% and 50% clay, as determined in accordance with ASTM D422.

3. Less than 55% sand content, as determined in accordance with ASTM D422.

4. PH between 5.0 and 8.0 as determined in accordance with ASTM D4972.

5. Meet the following mechanical criteria: 100% passes the 1-inch screen; 90-100% passes the No. 10 mesh sieve; and 40-60% passes the No. 100 mesh sieve.

F. Furnish the OWNER with the proposed source or sources of topsoil to be used at least fifteen (15) working days prior to delivery. Obtain soil samples from the intended topsoil source and have a soil analysis performed by a soil testing laboratory to ensure conformity with the preceding specification. Do not deliver topsoil to the work site prior to review by the OWNER.

2.2 SALVAGED TOPSOIL

A. Consists of the natural loam, sandy loam, silt loam, silty clay loam or clay loam humus-bearing soils available from the over-lying portions of the areas contemplated by the Plans or Contract to be occupied by the completed roadway.

2.3 SEED

A. Mixed and guaranteed by the dealer as provided in Table 32 92 00.00-1, located at the end of this Section.

B. Composed of seeds of the purity, germination and proportions, by weight, as given in Table 32 92 00.00-1, located at the end of this Section.

C. Seed mixture selection:

1. Seed Mixture #1: On average loam, heavy clay or moist soils.

2. Seed Mixture #2: On light, dry, sandy or gravely soils.

3. Seed Mixture #1 or #2: On all ditches, in-slopes, median areas and low fill areas.

4. Seed Mixture #3: On rural areas and high cut and fill slopes, generally exceeding 6 to 8 feet.

5. Seed Mixture #4: In urban or other areas where a lawn type turf is desired.

6. Seed Mixture #2 or #3: Suitable on very steep slopes where sterile soil and erosion conditions exist when used in conjunction with erosion control mat specified by the ENGINEER.

2.4 FERTILIZER

A. Use fertilizers for seeding, sodding, or other plantings that are standard, commercial, packaged or bulk products, in granular or liquid form conforming to Wisconsin Statutes and the Wisconsin Administrative Code Chapter ATCP 40. Ensure that each container of packaged fertilizer is plainly marked with the analysis of the contents showing minimum percentages of total nitrogen, available phosphoric acid, and soluble potash.

B. If using fertilizer with a total of nitrogen, phosphoric acid, and potash greater than 32%, apply them at a rate that provides equal nitrogen, phosphoric acid, and potash.

C. Fertilizer shall conform to the following minimum requirements:

1. Nitrogen, Not Less Than..... 16%

2. Phosphoric Acid, Not Less Than 6%

3. Potash, Not Less Than 6%

D. The total of nitrogen, phosphoric acid, and potash shall equal at least 32%.

E. Total nitrogen shall at least equal the sum of the phosphoric acid and soluble potash.

2.5 MULCH

A. Straw or hay in an air-dry condition, free of noxious weed seeds and objectionable foreign matter.

B. Use emulsified asphalt meeting the requirements of Type SS-1 of the Specifications for Emulsified Asphalt, AASHTO Designation M140, if asphalt is used. Use materials approved by the ENGINEER prior to use lieu of asphaltic materials for binding mulch.

PART 3 - EXECUTION

3.1. TOPSOIL

A. Grass areas require 4-inches of topsoil.

B. Prairie grass areas require 6-inches of topsoil. Finish grade 6-inches and deconsolidate to a minimum depth of 3-inches using a disc or other acceptable equipment.

C. Wetland/safety shelf areas require 12-inches of topsoil. Finish grade 12-inches and thoroughly deconsolidate to a minimum depth of 9-inches using a plow or other equipment. Deconsolidate topsoil to the point that the soil is very soft for planting of aquatic plants. Do not drive any equipment on topsoil after deconsolidation. If a vehicle is driven on the topsoil following final deconsolidation, the CONTRACTOR may be required by the OWNER to thoroughly deconsolidate the soil again.

D. Rake or drag the surface of the topsoil (except not in the wetland/safety shelf area) until smooth, friable and of uniformly fine texture.

3.2. SEEDING

A. Acceptable methods:

1. Base Method

a. Rake the ground until the surface is smooth, friable and of uniformly fine texture immediately before any seed is sown.

b. Seed areas evenly with a mechanical spreader at the rate of 5-pounds per 1,000 square feet for Seed Mixtures #1 through #4.

c. Rake lightly and roll with a 200-pound roller, and then water with a fine spray.

2. CONTRACTOR'S Option: Vary the method of seeding in accordance with Standard Specifications for Road and Bridge Construction of the State of Wisconsin, Current Edition, at the discretion of the CONTRACTOR, to establish a smooth, uniform, turf composed of the grasses specified using the seeding rates in base method.

B. Reseed any areas which fail to show a 'catch' or uniform stand with the original mixture. Repeat such re-seeding until final acceptance.

C. Repair damage resulting from erosion, gullies, washouts or other causes by filling with topsoil, tamping, re-fertilizing and re-seeding without extra cost to the OWNER.

D. Seed all disturbed areas in the project area unless otherwise specified.

3.3. FERTILIZER

A. Apply fertilizer containing 32% total of nitrogen, phosphoric acid, and potash at 7 pounds per 1,000 square feet, unless the Contract specifies otherwise. For fertilizer that contains a different percentage of components, determine the new application rate by multiplying the specified rate by a dimensionless conversion factor determined as follows:

Conversion Factor = 32 / New Percentage of Components

B. If fertilizing areas to receive sod, spread the fertilizer uniformly over the soil before sodding at the rate of 7 pound per 1,000 square feet and then work the fertilizer into the soil as part of the site preparation under Section 3.1.

3.4. MULCH

A. General

1. Place mulch on a given area within 3-days after the seeding has been completed.

2. Do not perform mulching operations during periods of excessively high winds, which would preclude the proper placing of the mulch.

3. Place mulch such that it is loose or open enough to allow some sunlight to penetrate and air to slowly circulate, but thick enough to shade the ground, conserve soil moisture and prevent or reduce erosion.

4. Maintain the mulched area and repair any areas damaged by wind, erosion, traffic, fire or other causes prior to final or partial acceptance of work under the contract documents.

B. Placing

1. Perform the work in accordance with Method A, Method B or Method C, or a combination thereof, unless a specific method is specified in the Contract Documents.

a. Method A

1) Spread the mulching material over the designated area to a loose depth of ½ to 1½-inches. Apply at a rate such that the resulting cover conforms to the requirements specified under Mulch, General. Loosen or fluff the mulch material from compacted bales before spreading in place. Unless otherwise directed, begin mulching operations at the top of the slopes and proceed downward.

2) Securely anchor straw or hay mulch by the use of an approved netting securely pegged or stapled in place. Another acceptable method is to secure the mulch means of heavy biodegradable twine fastened by pegs or staples to form a grid of from 6 to 10 feet spacing.

3) Another acceptable method is to place approved erosion control blankets or mats in lieu of separate applications of mulch and netting.

b. Method B

1) Treat straw or hay with a tackifier (as detailed in the following paragraphs), blow it from a machine and uniformly deposit it over designated areas on one operation. Place straw or hay uniformly over the area to a depth of ½ to 1-inch, using 1½ to 3-tons of mulch per acre. Mix and place tackifier in accordance with guidelines of the tackifier Product Acceptability List (PAL), Current Edition, published by the Wisconsin Department of Transportation. Place mulch within the above-designated limits and vary the rate of application of the mulch and the tackifier during mulching operations to produce the desired results. Use an approved type machine which will blow or eject by constant air stream, a controlled amount of mulch and which will introduce into the air stream a spray of tackifier to partially coat the straw or hay, producing a spotty tack sufficient to hold together and retain in

place the deposited straw or hay. As an option, apply the tackifier as an overspray in a separate operation after placing the straw or hay.

2) Apply wood fiber, wood chips or similar material with approved blowing machines or other approved methods which will place a controlled amount of mulch uniformly over the area to a depth of ½ to 1½-inches. Treat areas to be mulched with wood chips 1 lb. of available nitrogen per 1,000 square feet of area either prior to or after application of the chips.

3) Feed the mulch material into the blowing machine to produce a constant and uniform ejection from the discharge spout, operated in a position to produce a mulch of uniform depth and coverage.

a) Tackifiers - General Specifications:

i Latex-Base: Meet the following requirements:
(i) Composition, by weight, of the latex emulsion polymer
02.B.1.b.3.a.i.i.1. 48% Styrene
02.B.1.b.3.a.i.i.2. 50% Butadiene
02.B.1.b.3.a.i.i.3. 2% additive
(ii) 42.0 to 46.0% solids
(iii) pH, as shipped, of 8.5 to 10.0.
(iv) Do not allow the emulsion to freeze or to be exposed to sunlight for a prolonged period of time.

ii Guar Gum: Consist of a minimum of 9% Guar gum weight with the remainder being dispersing and cross-linking additives.

iii Other Tackifiers: Include, but not be limited to: Water soluble natural vegetable gums or Guar gums blended with gelling and hardening agents or a water soluble blend of hydrophilic polymers, viscosifiers, sticking aids, and other gums.

b) Tackifiers - Construction Methods:

i Mulch Anchoring: Anchor mulch by spraying the tackifier immediately after the mulch has been placed. Do not spray during periods of windy conditions that would prevent the proper placement of adhesive. Protect all traffic, signs, structures and other objects from being marked or disfigured by the tackifier material. Apply tackifiers at the following minimum rates per acre:
(i) Latex-Base: Mix 15-gallons of adhesive or the manufacturer's recommended rate, whichever is greater, with a minimum of

250-lbs. of recycled newsprint as a tracer with 375-gallons of water.

(ii) Guar Gum: Mix 50-lbs. of dry adhesive and a minimum of 250-lbs. of recycled newsprint as a tracer with 1,305-gallons of water.

(iii) Other Tackifiers: (Hydrophilic Polymers) mix 97 lbs. of dry adhesive or the manufacturer's recommended rate, whichever is greater and a minimum of 250-lbs. recycled newsprint as a tracer with 1,305-gallons of water.

c) Approved Tackifiers:

i Latex Base Adhesive:

Product	Manufacturer
BUTOFAN NS268	BASF Corporation

ii Guar Gum Base Adhesive:

Product	Manufacturer
Lawn Tack	Amturf Seeds
Second Nature Tacpac GTX	Central Filter Corp.
Finn A500 Hydro-Stik	Finn Corporation
Eco Tak-OP	Eastern Products, Inc.
Landtack	Erosion Control Tech.

iii Other Tackifiers (Hydrophillic Polymers):

Product	Manufacturer
Exact-Tac (E-T)	American Excelsior
Con-Tack A/T	Con Wed
Eco Tak-SAT	Eastern Products, Inc.
RMB Plus	Reinco Company

c. Method C

1) Spread the straw or hay mulch uniformly over the designated areas to a loose depth of ½ to 1½-inches, using 1½ to 3-tons of mulch per acre, by blowing from a machine, as described in Method B, or by other approved methods.

2) Immediately after spreading, anchor the mulch in the soil by the use of a mulch tiller consisting of a series of dull, flat discs with notched edges. Use discs approximately 20-inches in diameter and spaced at about 8-inch centers. Use tiller equipped with a ballast compartment to permit adjustment of the weight for depth control.

3) Impress the mulch in the soil to a depth of approximately 1½ to 2½-inches in one (1) pass of the tiller traveling longitudinally. Do not operate mulch tillers on slopes so steep that damage to the mulch, seed bed or soil occurs. Anchor the mulch on such areas by either Method A or Method B. Use tractors equipped and operated to minimize the disturbance or displacement of the soil. Provide more than one pass of the tiller to assure adequate anchoring of the mulch, if required.

3.5. ADJUSTING MANHOLES, INLETS, VALVES AND STOP BOXES

A. Adjust all manholes, inlets, valves, stop boxes, and other fixtures to the plan grade and alignment. This work is incidental to landscaping and restoration.

B. Include the repair of the uppermost 12-inches of the existing concrete structure in manhole and inlet adjustment.

3.6. WATERING

A. Provide watering of landscape areas for one (1) month after installation.

END OF SECTION

TABLE 32 92 00.00-1

TABLE OF SEED MIXTURES

			MIXTURES			
Species	% Purity	% Germination	% in #1	% in #2	% in #3	% in #4
Kentucky Bluegrass	98	85	50	10	20	50
Creeping Red Fescue	97	85	25	--	30	30
Perennial Ryegrass	97	90	25	30	--	--
Hard Fescue	97	85	--	25	25	--
Tall Fescue	98	85	--	35	--	--
Improved Fine Perennial Rye Grass	96	85	--	--	25	20

DIVISION 33 – UTILITIES

SECTION 33 01 30.11

CLEANING & VIDEO INSPECTION OF PIPE LINE

PART 1 - GENERAL

1.1. SUMMARY

A. Section Includes

1. Cleaning and video inspection of pipe lines requirements, report requirements, and traffic control requirements.

B. Scope of Work

1. Provide required signage and traffic control to assure a safe project.

1.2. REFERENCES

A. U.S. Department of Labor Occupational Safety and Health Administration (OSHA) – Occupational Safety and Health Act

B. U.S. Department of Transportation Federal Highway Administration (FHWA) – Manual on Uniform Traffic Control Devices

1.3. SUBMITTALS

A. Product Data

1. Submit technical literature detailing the construction and capabilities of the equipment proposed for this cleaning and inspection.

B. Work Plan & Schedule

1. Submit, for review by the OWNER and ENGINEER, a proposed plan of action for cleaning and inspection of the sanitary sewers.

1.4. QUALITY ASSURANCE

A. Qualifications

1. Submit for review by the OWNER and ENGINEER, a resume showing that the CONTRACTOR proposed for this project has at least 5-years of experience in pipe line cleaning and video inspection.

2. Provide a list of at least three (3) sewer cleaning and televising projects (with similar sized pipe) with references including the following:

a. Location.

b. Date.

c. Diameter and Length of Interceptor.

d. Project Cost.

e. Client Contact Person.

f. Telephone Number.

B. Regulatory Requirements

1. Comply with Federal, State, and local requirements.

PART 2 - PRODUCTS

2.1. MATERIALS

A. Video Recording

1. Record inspection on a DVD or flash drive, capable of being viewed on a DVD player or Windows® media player.

2.2. EQUIPMENT

A. Closed Circuit Television Camera

1. Television equipment includes television camera, television monitor, cables, power source, lights and other equipment. Use a television camera specifically designed and constructed for operation in connection with sewer inspection meeting these minimum requirements:

a. Pan & Tilt Radial View Color Sewer TV Camera.

b. 360 Degree Radial x 300 Degree Pan & Tilt Viewing Field.

c. Multi-Conductor.

d. Remote Adjustable Optical Focus, Remote Light Compensating Iris.

e. Automatic White Balance Circuitry, NTSC Color.

f. Low Light, 3 Lux Camera.

2. Provide a pan and tilt view camera specifically designed to provide a close-up view of sewer pipe walls and lateral entrances using a low light sensitive camera, movable camera head and directional lighting. The unit is color and designed for operation through up to 2,000 feet of multi-conductor cable in sanitary and storm sewers. Chassis construction is 100% solid state circuitry designed to withstand shocks and vibration normally sustained while being pulled through a pipe. The image pick-up device is a low light sensitive, 3 Lux, solid-state camera

incorporating the latest high-resolution closed-circuit television technology. Operating climatic ranges of the camera are 14ºF to 86ºF, and up to 100% relative humidity.

3. Provide remote reading footage counter accurate to 1% over the length of the particular section being inspected and mounted over the television monitor.

B. Sewer Cleaning Equipment

1. Provide a jet cleaner with a vacuum/air transport debris removal system.

2. Provide a water pump system on the cleaning vehicle with the ability to pump between 50 to 65-gallons per minute at a pressure of 1,200 to 1,500 pounds per square inch. Do not provide units with pumps smaller than this.

PART 3 - EXECUTION

3.1. PREPARATION

A. Cleaning Requirements

1. Remove debris and sediment to assure that the sanitary sewer can perform as designed.

2. Notify the ENGINEER and the OWNER immediately if the cleaning must be suspended due to adverse weather conditions or unforeseen obstacles.

3. Dispose of debris removed from the sewers during the cleaning process in compliance with all Federal, State and local requirements. Dispose of these materials and pay all fees associated with the disposal. The OWNER will not provide a disposal site.

B. Traffic Control

1. Obtain written permission from the authorized official of the Municipality and, if applicable, the appropriate County or State Highway Official or property owner prior to placing devices intended to close alleys, streets, highways, thoroughfare, traffic lane, or public or private way. Notify the Chiefs of the Fire and Police Department(s) of the affected municipality(ies) prior to any such closure.

2. Erect and maintain barricades, guardrails, lights and signs necessary for public safety and convenience. Mark all hazards within the limits of the work or on detour around the work with well-painted, well-maintained, barricades, lanterns, torches, flares, reflectors, electric lights, flashers or caution, warning and directional signs in sufficient quantity and size to adequately protect life and property. Move, change, increase or remove these safeguards as required during the progress of the work to meet changing conditions.

3. Conduct traffic control operations in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and local requirements.

4. Maintain barricades in rigidly assembled condition. Keep barricades clean and the reflecting strips in good repair to be readily discernible at all times.

5. Handle materials using provisions for the protection of traffic and the public. Make reasonable and satisfactory provisions for travel on sidewalks, crosswalks, streets, roads, railroads and private ways.

6. Comply with "Occupational Safety & Health Act" (OSHA) requirements issued by the Federal Government and/or adopted by the State and local laws, rules and regulations, as they apply.

7. The OWNER reserves the right to remedy any neglect on the part of the CONTRACTOR as regards to protection of the work and public after 24-hours notice, in writing. In the case of emergency, the OWNER reserves the right to remedy any neglect without due notice. In either case, the cost of such remedy will be deducted from any money due or to become due to the CONTRACTOR.

C. Security

1. Provide site security. Provide (if deemed necessary) such watchmen and take such other precautionary measures as deemed necessary to protect CONTRACTOR's interests.

D. Temporary First Aid Facilities

1. Comply with the requirements of the "Manual of Accident Prevention in Construction", Associated General Contractors of America, Inc., latest edition, Section 2, First Aid, and supply on the site a first aid kit, dust-proof, protected from heat and moisture and containing, as a minimum, the first aid items listed according to the number of employees.

3.2. CONSTRUCTION

A. Pollution Control

1. Comply with all Federal, State and local requirements covering pollution control.

2. Ensure that all incoming wastes receive treatment equivalent to the treatment currently being provided.

B. Sewer Flow Control

1. When sewer depth of flow at the upstream manhole of the manhole section being worked is above the maximum allowable for television inspection, joint testing and/or sealing; reduce the flow to the level shown below by operation of pump stations, plugging or blocking of the flow, or by pumping and bypassing of the flow, as specified.

2. Do not exceed the depth of flow shown below for the respective pipe sizes, as measured in the manhole when performing television inspection.

a. 6 to 10-Inch Pipe 20% of Pipe Diameter

b. 12 to 24-Inch Pipe 25%oOf Pipe Diameter

c. 27-Inch & Larger Pipe 30% of Pipe Diameter

3. Plugging or Blocking:

a. Insert a sewer line plug into the line upstream of the section being worked. Use a plug designed so that all or any portion of the sewage can be released. During television inspection or testing and sealing operations, reduce flow to within the limits specified above. After the work has been completed, remove plug and restore flow to normal.

4. Pumping & Bypassing:

a. When pumping and bypassing is required, supply pumps, conduits and other equipment to divert the flow of sewage around the manhole section where work is being performed. Provide a bypass system of sufficient capacity to handle existing flow, plus additional flow that may occur during a rainstorm. Furnish the necessary labor and supervision to set up and operate the pumping and bypassing system. If pumping is required on a 24-hour basis, equip engines in a manner to keep noise to a minimum.

5. Flow Control Precautions:

a. When flow in a sewer line is plugged, blocked or bypassed, protect the sewer lines from damage that might result from sewer surcharging. Ensure that sewer flow control operations do not cause flooding or damage to public or private property being serviced by the sewers involved.

C. Television Inspection

1. Notify the ENGINEER and the OWNER immediately if the televising must be suspended due to adverse weather conditions or unforeseen obstacles.

2. Move the camera through the line in either direction at a uniform rate, stopping when necessary to ensure proper documentation of the sewer's condition. Do not pull the camera at a speed greater than 30 feet per minute. Use manual winches, power winches, TV cable and powered rewinds, or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions, to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire manhole section, reset the equipment in a manner so the inspection can be performed from the opposite manhole.

3. In the event the section being televised has substantial flow entering the sewer between manholes, such that inspection of the sewer is impaired, coordinate with the OWNER of source of flow to have such flow temporarily stopped and/or

reschedule television inspection of the particular section to a time when such flow is reduced to permit proceeding with the television inspection.

4. When sewer line depth of flow at the upstream manhole of the section being televised is above the maximum allowable for television inspection, reduce the flow to permit proceeding with the television inspection.

5. Whenever non-remote powered and controlled winches are used to pull the television camera through the line, use telephones, radios or other suitable means of communication between the two (2) manholes of the section being inspected to ensure that adequate communications exist between members of the crews.

6. Check accuracy of the measurement meters daily by use of a walking meter, roll-a-tape or other suitable device. Begin footage measurements at the sewer line point of penetration of the upstream manhole, unless specific permission is given to do otherwise. Show footage on the video data view at all times.

D. Documentation of Television Results

1. Document television inspections using an in-vehicle computer system. This system must be IBM compatible. Supply a report documenting defects and general information on the pipe being viewed along with an index for retrieving the information to the OWNER.

2. Provide typed or computer printed television inspection logs to the OWNER. Show the location, in relation to adjacent manholes, of each source of infiltration discovered in the location reports. Record other data of significance, including the location of buildings and house service connections, joints, unusual conditions, roots, storm sewer connections, collapsed sections, presence of scale and corrosion, and other discernible features. Provide a voice recording on the DVD or flash drive with brief and informative comments on the sewer conditions.

3. Prepare color DVD or flash drive recordings of the data on the television monitor. Provide two (2) copies of each DVD or flash drive; one (1) for the OWNER, and one (1) for the ENGINEER.

4. Record for playback at the same speed that it was recorded. Provide tabs for the start of each sewer segment. Provide title to the DVD or flash drive to the OWNER. Provide DVD's or flash drives and necessary playback equipment for review by the OWNER during the project.

5. Include the following information on the DVDs or flash drives:

   a. Data View:

      1) Report number.

      2) Date of television inspection.

      3) Upstream and downstream manholes numbers.

4) Current distance along reach.

5) Printed labels on the container and DVD or flash drive, with location information, date, format information and other descriptive information.

b. Audio:

1) Date and time of television inspection, operator name and name of adjacent street.

2) Verbal confirmation of upstream and downstream manhole numbers and TV direction in relation to direction of flow.

3) Verbal description of pipe size, type and pipe joint length.

4) Verbal description and location of each service connection and pipe defect.

5) Type of weather during inspection.

6. Include the following information on the computerized logs:

a. Location of each point of leakage.

b. Location of each service connection.

c. Location of any damaged sections, nature of damage and location with respect to pipe axis.

d. Deflection in alignment or grade of pipe.

e. Record of repairs and quantity of sealing material used (if applicable).

f. Date, time, municipality, street, basin, manhole section, reference manhole number, name of operator, inspector and weather conditions.

g. Pipe diameter, pipe material, section length and corresponding DVD or flash drive identification.

7. Complete and submit to the OWNER sanitary manhole record information for each manhole in the project.

8. Provide sufficient information for evaluation purposes for rehabilitation, repair, and replacement strategies on the television inspection DVD or flash drive. Provide a DVD or flash drive to allow the pipe to be evaluated for trenchless rehabilitation.

E. Manhole Inspection Reports

1. Prepare a Manhole Inspection Report for each manhole.

2. Provide digital photographs of each manhole including:

   a. Casting / frame at ground surface.

   b. Bench.

   c. General inside.

   d. Observed leaks or structural failures.

3. Provide printed copies of digital photos with all photographs of each structure on one (1) each 8½" x 11" sheet.

4. Provide a DVD or flash drive with all pictures indexed by a structure identification number, which is the same as the structure identification number included in the televising reports.

F. Lateral Televising / Tracing

1. Televise and trace laterals utilizing a camera launched from the main line sewer.

2. Mark laterals along the ground surface using marking flags, paint or washable chalk as appropriate. The OWNER or ENGINEER will field collect the markings to identify the route of the lateral from the main sewer line to the building.

END OF SECTION

SECTION 33 05 22.00

UTILITY TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1. SECTION INCLUDES

A. Installing underground utilities using the open cut trenching method.

1.2. RELATED SECTIONS

A. Section 33 10 00.00 – Water Main

B. Section 33 30 00.00 – Sanitary Sewerage

C. Section 33 34 00.00 – Sewerage Force Main

D. Section 33 40 00.00 – Storm Sewerage

1.3. MEASUREMENT PROCEDURES

A. Rock Excavation in Trenches

1. Measure 1 foot outside the wall lines of the manhole.

2. Measure a 30-inch width for pipe sized up to and including 12-inch pipe.

3. Measure the nominal inside pipe diameter plus 18-inches for pipes larger than 12-inches.

4. Measure to a maximum depth of 6-inches below the outside bottom of the pipe barrel.

5. Measure 1 foot outside of the outside wall surfaces of manhole.

1.4. PAYMENT PROCEDURES

A. Include cost of trenching, backfilling, and compacting backfill in the unit price bid per foot for the type of pipe installed.

B. Rock Excavation in Trenches

1. Pay per cubic yard of rock removed.

2. Additional rock removed for CONTRACTOR’s convenience will not be paid.

PART 2 – PRODUCTS

2.1. OPTIONAL SPECIAL BACKFILL

A. Aggregate Slurry

1. Aggregate mixed with water to inundate the aggregate and provide an approximate 3-inch slump.

Sieve Sizes	Percentage Passing by Weight
1-inch	100%
¾-inch	90-100
3/8-inch	20-55
No. 4	0-10
No. 8	0-5

B. Flowable Fill

1. Highly flowable utility trench mix containing 50 lbs. of Type I cement (ASTM C-150), 100 lbs. of Class C Flyash (ASTM C-618), and approximately 2,500 lbs. of Fine Aggregate (ASTM C-33).

2. Air entrainment of 10% to 30%.

3. Provide a maximum 28-day compressive strength of 150 psi.

4. Submit mix design and strength reports to ENGINEER for review. Include sufficient water content to provide a consistency resulting in a self-leveling product at the point of placement.

PART 3 – EXECUTION

3.1. PROTECTION OF EXISTING STRUCTURES & UTILITIES

A. Protect against damage surfaces and features, including buildings, pavements, trees and shrubs, within and adjacent to the construction easement or right-of-way, which are to be saved as indicated on the drawings or by the ENGINEER.

B. Support and protect existing gas pipes, water pipes, steam pipes, electric and telephone other surface or subsurface structures, either of a private or of public ownership, whether or not indicated or shown on the drawings. Perform such work at CONTRACTOR'S expense, and according to their own drawings.

C. Contact public utilities for the location of their underground structures such as ducts, mains or services for electric power, gas and telephone. Support above ground poles for electric power, lighting and telephone wires and cables. If the CONTRACTOR damages such utilities or subsurface structures, they shall make settlement with the OWNER(s) of the utility (ies).

3.2. INTERFERENCE OF UNDERGROUND STRUCTURES

A. Notify ENGINEER and OWNER when an unknown underground structure is encountered in the trench or tunnel of the proposed utility and because of interference part or all of the structure requires relocation.

B. Notify the ENGINEER and the OWNER of underground structure of CONTRACTOR'S desire to temporarily relocate such structure or to discontinue the service therein, and receive from the OWNER of such underground structure permission for such relocation or discontinuance of service if the relocation is to be made for CONTACTOR'S convenience. Replace structure to original position and condition. Structure owner may perform the work in connection with said relocation, discontinuance or replacement at the CONTRACTOR'S expense.

C. Protect, support, or brace existing underground structures where the excavation of either a trench or tunnel extends under or approaches it.

3.3. TRENCHING

A. Support tunnel sections exceeding 2 feet in length in accordance with the applicable codes.

B. Excavate the maximum typical trench width from 2 feet above the top of the pipe to the trench bottom to the outside diameter of the pipe plus 24-inches. Excavate wider to facilitate trench shields or trench boxes, if applicable. Keep the trench walls vertical whenever possible. Do not side slope or "bench down" in the trench where the trench is excavated within a permanent pavement or where such side-sloping or benching would encroach upon private property or endanger existing or future underground utilities or structures.

C. Excavate trenches straight between designated angle points to permit the pipe to be laid straight and true to line and grade.

D. Where the normal trench width below 2 feet above the top of the pipe is exceeded for any reason, except due to the use of tight sheeting, furnish an adequate section for the actual trench width. Accomplish this by furnishing a stronger pipe, a concrete cradle, cap, or envelope, whichever is an adequate section. You may use tight sheeting in lieu of a stronger pipe section to maintain the required trench width for the required height and depth. When the pipe specified is strong enough for the actual trench width, no further provision is required for the greater trench width.

E. Excavate the trench to the required depth below the flow line (invert) of the pipe line being constructed allowing for the thickness of the pipe and the depth required for bedding. If the CONTRACTOR excavates too deep for underground mains, refill all such excavated space with such material and in such manner as directed by the OWNER. Refill the excavated space below the main(s) with special bedding if required by the specifications.

F. Backfill as speedily as possible. Do not leave backfilling unfinished more than 100 feet behind the completed pipe work unless permitted by the OWNER. Do not perform new trenching when earlier trenches need backfilling or labor is needed to restore the surfaces of streets or other areas to a safe and proper condition. Do not excavate more than one (1)

street crossing by the same trench at any one time. Install and maintain barricades and warning devices around open trenches.

G. Place steel plates with minimum dimensions of 4' x 8' x 1" to bridge open trenches crossing roadways. Secure the plates against the possibility of shifting or dropping into the excavation. During winter months, do not leave these plates in the roadway overnight unless approved by the OWNER.

H. Unstable Foundation

1. Remove and replace undesirable material below the trench bottom, manhole or any structure, such as organic soils, etc., which cannot adequately support the sewer, with crushed stone. OWNER will pay for additional excavation and stone fill in accordance with the prices listed in the Schedule of Supplemental Unit Prices. Where the distance to stable ground is excessive, the OWNER reserves the right to order, in writing, as an extra, such other types of foundation as deemed necessary.

2. Inform ENGINEER immediately, and later in writing, of all locations of unstable trench conditions where additional stone fill is required.

I. Pipe Bedding Sections & Materials

1. Use one of the following bedding sections for pipe line construction, unless otherwise stated in the Special Provisions.

2. Standard Section, Class C

a. Excavate trench to allow 4-inches of bedding material under the pipe barrel and 3-inches of bedding material under the bell.

b. Place and compact bedding material to springline of the pipe.

c. Place and compact excavated material to a point 2 feet above the top of the pipe. Acceptable excavated material is free of stones larger than 2-inches in diameter, sections of concrete, or any material considered unsuitable for backfill by the ENGINEER.

d. Acceptable bedding material is shown in Table 33 05 22.00-2, Table 33 05 22.00-3 or Table 33 05 22.00-4 (located at the end of this section).

e. Fill excess depth with Class D concrete or crushed stone if excavation is deeper than 6-inches below the pipe barrel.

3. Compacted Section, Class B

a. Excavate trench to allow 4-inches of bedding material under the pipe barrel and 3-inches of bedding material under the bell.

b. Place and compact bedding material to a point 12-inches above the top of the pipe.

c. Acceptable bedding material is shown in Table 33 05 22.00-2, Table 33 05 22.00-3 or Table 33 05 22.00-4 (located at the end of this section).

d. Fill excess depth with Class D concrete or crushed stone if excavation is deeper than 6-inches below the pipe barrel.

4. Submit bedding material sieve analysis to ENGINEER prior to the beginning of construction.

5. Provide up to an additional 3-inches of crushed stone below the 4-inch pipe bedding as required to facilitate trench drainage in wet trench conditions. Include in the unit price bid per foot of pipe line.

J. Backfilling Trenches

1. Excavated Material for Backfill

a. Acceptable excavated material: loam, clay or other materials that, in the judgment of the ENGINEER, are suitable for backfilling.

b. Unacceptable backfill materials: vegetable or other organic matter, all types of refuse, large pieces or fragments of concrete, large stones or boulders and such other material as in the judgment of the ENGINEER are unsuitable for backfilling, and frozen backfill.

c. Replace unacceptable excavated material with suitable clay, loam, or gravel backfill upon the written order of the OWNER as an extra.

d. Backfill the trench section above the bedding section of all pipe lines to a level 3 feet above the pipe with material free of any stones or concrete larger than 3-inches in diameter.

e. Do not use excavated rock within 10 feet of any manhole.

2. Special Backfill

a. Backfill with special backfill under aggregate bases or paved surfaces.

b. Acceptable Material

1) Meets sieve analysis specified in Table 33 05 22.00-5.

2) Consists of durable particles including unwashed bank run sand and crushed bank run gravel.

3) Approved bedding material for sewer installation.

4) Material excavated from any sewer, water or force main trench that, in the opinion of the ENGINEER, is found to meet the requirements for special backfill.

c. Mechanically compact special backfill.

K. Surface Restoration

1. Restore the project area to a "before construction" condition. The opinion of the OWNER is final in determining the condition of the project site restoration.

2. Restore asphalt, concrete or gravel surfaces in accordance with the requirements of the base aggregates, asphaltic concrete paving, concrete pavements, concrete curb & gutter, concrete sidewalk & driveway, and pavement and resurfacing specifications.

3. Restore unpaved surfaces in accordance with the requirements of the landscaping specification.

L. Compaction of Trench Backfill

1. Compaction requirements (see Table 33 05 22.00-1, located at the end of this section).

2. Acceptable Methods

a. Flooding or Jetting

1) Provide and purchase water.

2) Equip hose with regulating valve.

3) Furnish 1½-inch minimum diameter hose.

4) Furnish 1½-inch minimum diameter and 4 foot minimum length nozzle.

5) Insert nozzle at maximum spacing of 3 feet.

b. Mechanical Compaction

1) Compact initial lift to 2 feet thick.

2) Compact subsequent lifts to 12-inches to 15-inches thick.

M. Notify ENGINEER and OWNER a minimum of 48 hours prior to commencing work.

3.4. PIPE BORING & JACKING

A. CONTRACTOR'S Option

1. For pipe installations shown as open cut, CONTRACTOR may bore or jack pipe at CONTRACTOR’s expense unless specified elsewhere or indicated on the drawings.

2. Submit for review details giving the limits of the proposed jacking or boring, the method and equipment to be used and the location of the shaft, pit or approach tunnel.

3. Obtains permits and conform to the requirements of the railroad or highway permit issued for this work.

B. Boring

1. Unless the Railroad or Highway Department has a preference, bore using one of the following methods:

   a. Push conduit pipe into the earth as the boring auger drills out the ground.

   b. Drill hole through the earth and push the conduit pipe into the hole after the drill auger has completed the bore.

2. Bore hole larger than the outside diameter of the bell of the pipe to be installed.

3. Boring without a casing pipe is limited to a maximum of 16 feet with no water pipe joint permitted within the bore.

C. Jacking

1. Do not perform jacking: 1) in dry sand; 2) in gravelly soil known to contain large boulders; 3) through fills where logs or stumps are known to exist; or 4) where it is impractical to lower the water table below the excavation.

2. Test soil conditions by boring or sampling before deciding upon jacking in all questionable soils.

3. Excavate approach trench into the fill, embankment or virgin soil far enough to provide a jacking face of 3 feet or more above the pipe. Securely shore open face to prevent slipping or raveling. Provide a sump for drainage of trench. Provide a backstop of sufficient strength to take thrust of jack.

D. Casing Pipes

1. Meet the requirements of the highway department or the railroad.

E. Inserted Pipe

1. The carrier pipe shall be as specified in the Special Provisions, if applicable.

2. Install inserted pipe to line and grade shown on the drawings or as directed by the ENGINEER. Failure to install the casing pipe that permits installation of the carrier pipe to the specified grade may be cause for rejection of the work.

3. Sanitary Sewer

a. Support and brace sewer pipe to prevent shifting or flotation. Fill annular space between carrier pipe and casing pipe with blown sand or cement grout.

4. Water Main

a. Support carrier pipe with Pipe Line Seal & Insulator, Inc. (PSI)'s casing spacers.

b. Install spacers a maximum of 1 foot from ball and flange of each pipe.

c. Install spacers a maximum of 10 feet apart.

d. Do not fill annular space.

e. Install PSI, Model W, wrap-around casing end seal.

3.5. ROCK REMOVAL

A. Rock Classification

1. Includes:

a. Solid or ledge rock, including shale and slate, sandstone or other hard materials that are not decomposed, weathered, loose, layered or shattered, and require the continuous use of pneumatic tools, drilling and blasting, or heavy ripping.

b. Boulders and pieces of concrete or masonry exceeding 2,000 pounds in weight, or one half (½) cubic yard in volume.

2. Provide the ENGINEER sufficient notice (at least 24-hours) in order to make the measurements necessary for volume computation.

B. Removal by Blasting

1. Comply with requirements of Wisconsin Administrative Code Chapter SPS 307 and local ordinances.

2. Damage to Existing Facilities

a. Remove damaged facilities and reconstruct them, or furnish materials and perform such work or repairs or replacements as the OWNER may order.

b. Repair or replace at own expense.

c. CONTRACTOR is responsible for any and all damages and claims arising from such blasting or by accidental explosions, and for the defense of all actions arising from such causes.

3. Blasting Subcontractor

a. Furnish a certificate of insurance to the OWNER for the limits specified in the General Requirements.

b. Provide the OWNER proof that they have the proper Blasters' License Classification, as defined in the Wisconsin Administrative Code Department Of Safety and Professional Services, Chapter SPS 307 to perform the work in this project.

C. Pre-Blast Survey

1. Perform a pre-blast survey on all buildings and improvements within and adjacent to the area of rock removal.

2. Survey includes:

a. Videotapes or compact discs of improvements, building exteriors and building interiors, where access can be obtained from property owners.

b. Inspection results and confirmation of contact with property owners.

3. Notify in writing each property owner located adjacent to an area to be blasted of the proposed schedule for blasting at least 1-week prior to the date blasting is scheduled for that area. Provide ENGINEER and OWNER a copy of the notification.

D. Blasting Requirements

1. Perform all blasting within public highway right-of-way either directly or under direct supervision of a qualified blaster who has a currently effective Class 5, 6, 7 Blaster's License issued by the State of Wisconsin. Provide copies of the license verifying class and issuance dates to the ENGINEER within 30-days of contract award.

2. Comply with all state and federal codes applicable to the storage and use of explosives and, particularly, to the Explosives and Fireworks Codes as administered by the Wisconsin Department Of Safety and Professional Services, Chapter 307, Explosives and Fireworks. Copies of the code are available from "WI Department of Administration, Document Sales and Distribution Section, 202

South Thornton Avenue, P.O. Box 7840, Madison, WI 53707-7840"; "docsales@doa.state.wi.us"; or "http://www.doa.state.wi.us/section detail.asp".

3. Notify appropriate officials of the State of Wisconsin DOC prior to any of the proposed blasting. Do not commence blasting until the said department has indicated its approval or its non-objection.

4. Notify by contacting:
   Wisconsin Department of Commerce
   Mine Safety Section
   201 East Washington Avenue, Room #103
   Madison, WI 53703
   Telephone: (608) 266-7529

5. Provide sufficient warning signs and devices and perform operations in a manner to assure that persons and properties are protected from injury or damage throughout all phases of the work.

6. Provide precautions against the use of radio-frequency devices in blasting environments.

7. Confine blasting operations to hours approved by the OWNER. Do not perform blasting over any weekend or on any holiday.

8. Notify public utilities, private or cooperatively owned utilities and the owner and occupants of properties that might be affected by the work.

9. Signs for Blasting Areas

   1) Consult the Institute of Makers of Explosives, Publication No. 20, "Radio Frequency Energy, A Potential Hazard in the Use of Electric Blasting Caps", for information on guidelines for safe operation. This publication provides tables of recommended safety distances, which will give the blaster a high degree of assurance that their blasting layout should be safe against Radio Frequency (RF) initiation.

      a) Blasting Zone Sign (W22-1)

         (1) Provide a **BLASTING ZONE (1000) FT** sign in advance of the **TURN OFF 2-WAY RADIO** and **END BLASTING ZONE** signs. Cover or remove the sign sequence when there are no explosives in the area or the area is otherwise secured.

      b) Turn Off 2-Way Radio (W22-2)

         (1) Provide **TURN OFF 2-WAY RADIO** sign in advance of the **BLASTING ZONE (1000) FT** sign and **END BLASTING ZONE** sign at least 1,000 feet from the beginning of the blasting zone. Cover or remove the sign

sequence when there are no explosives in the area or the area is otherwise secured.

c) End Blasting Zone (W22-3)

(1) Provide **END BLASTING ZONE** sign a minimum of 1,000 feet beyond the blasting zone.

E. Vibration Limitation & Recording

1. Furnish, install and operate instrumentation and provide a qualified blasting specialist to supervise the installation of the instruments and interpret the recorder results.

2. Submit plan for monitoring blasting operations to assure compliance with the vibration limitation prior to commencement of the blasting operations. Include the following in the plan:

a. Recommended vibration limitation.

b. Seismograph recordings of vibrations for each blasting occurrence.

c. Names of the trained personnel provided to operate the equipment and interpret the recordings.

3. Proved blasting so that vibrations reaching adjacent structures and facilities are within safe limits.

4. Monitor vibrations by measuring the peak particle velocity in the vicinity of blasting. Peak particle velocity is the maximum of the three (3) velocity components, measured in three (3) mutually perpendicular directions at any point by an appropriate instrument. Do not exceed 2.0-inches per second peak particle velocity on or at the structure closest to the point of blasting operations.

5. Measure the air blast pressure with an instrument making a permanent record for each blast when blasting at the ground surface is conducted in the vicinity of a structure susceptible to damage. Do not exceed 0.01 psi mean peak over-pressure at the nearest structure or at the nearest project property line, except as modified herein.

6. Blast Vibration Specialist

a. Supervise establishment of the program and initial operation of the equipment.

b. Visit the job site at least once per week

c. Inspect the recording program and interpretation of records.

d. Check the operations.

e. Provide the ENGINEER with a comprehensive written report of the vibration measuring program and an analysis of the velocity and over-pressure recordings within 30-days after completion of the blasting operations,

7. Suspend blasting operations immediately in the event any recordings indicate that the vibration limits are being exceeded. Report this Immediately to the ENGINEER. Reduce the size of loads, use millisecond delay detonators, or take other appropriate measures to reduce the resulting vibrations.

8. Provide results and interpretation of all blasting records to the ENGINEER within 24-hours of blasting.

F. Blasting Records

1. Provide a record of each blast detonated and make records available to the OWNER at all times. Include the following:

a. Depth of blast holes and the location of the blast point in relation to the project stationing.

b. Type and strength of explosives, type of blasting caps and distribution of delays used.

c. Vibration record.

d. Total explosive loading per round and per delay.

e. Comments by the blaster in charge regarding any misfires, unusual results or unusual effects.

f. Date and exact fire and time of blast.

g. Name of person in responsible charge of loading and firing and blaster permit number.

h. Signature and title of person making recording entries.

2. Any other records required by State in which the work is performed, and local codes and regulations.

G. Provide personnel fully trained in their respective duties as part of the directional drilling crew and in safety

H. Provide project specific training if any potential hazards may be encountered which have not already been included in personnel's training.

END OF SECTION

TABLE 33 05 22.00-1

Excavated Area	Percent Compaction Fine-Grained Soil	Percent Compaction Coarse-Grained Soil	Relative Density *
Within 10' of building lines under footings, floor slabs and structures attached to buildings (i.e., walls, stoops, steps); and the upper 4' or a distance twice the trench width, whichever is greater, of any trench located under any concrete or asphalt paved surfaces.	90%	95%	70%
10' beyond building lines under walks, driveways, curbing, concrete or asphalt paving; sub-grade preparation; and the remaining section of any trench located under these paved surfaces.	80%	90%	60%
10' beyond building lines under seeded, sodded and landscaped areas, and any trench located under these areas.	80%	90%	---

Coarse-grained soils are classified as those soils with more than 50% (by weight) larger than the No. 200 mesh sieve and with a plastic index less than 4.

Compaction requirements maximum density shall be determined by AASHTO Designation T99, Method C, with replacement of the fraction of material retained in the 3/4-inch sieve with No. 4 to 3/4-inch material.

**Minimum relative density requirements apply to coarse-grained soils and apply only in cases where the percentage compaction requirements are not being reached.*

TABLE 33 05 22.00-2

BEDDING MATERIAL FOR SEWERS 18-INCHES IN DIAMETER OR LESS

Crushed pit-run gravel, pea gravel or crushed stone chips shall conform substantially to these grading requirements: (3/8-inch size).

Sieve Size	Percentage Passing By Weight
1-inch	100
3/4-inch	95-100
3/8-inch	30-55
No. 4	0-10
No. 8	0-5

TABLE 33 05 22.00-3

BEDDING MATERIAL FOR SEWERS LARGER THAN 18-INCHES IN DIAMETER

Crushed pit-run gravel, pea gravel or crushed stone chips shall conform substantially to these grading requirements: (3/4" size).

Sieve Size	Percentage Passing By Weight
1-inch	100
3/4-inch	95-100
3/8-inch	20-55
No. 4	0-10

TABLE 33 05 22.00-4

BEDDING MATERIAL FOR WATER MAINS & FORCE MAINS

Bedding sand shall consist of durable particles ranging in size from fine to coarse in a substantially uniform combination. Unwashed bank-run sand, rejected concrete sand and crushed bank-run gravel will be considered generally acceptable under this specification. The presence of approximately 6% of fine clay or loam particles is desirable, but clay or loam lumps are not permitted. The maximum moisture content shall be 10%. Bedding sand shall conform substantially to these grading requirements:

Sieve Size	Percentage Passing By Weight
1-inch	100
No. 16	45-80
Material Finer Than No. 200	2-10

TABLE 33 05 22.00-5

REQUIREMENTS FOR SPECIAL BACKFILL

Sieve Size	Percentage Passing By Weight
2-inch	95-100
3/4-inch	70-100
No. 4	35-65
No. 40	15-45
No. 200	5-15

SECTION 33 40 00.00

STORM SEWERAGE

PART 1 - GENERAL

1.1. SECTION INCLUDES

A. Storm sewer, manholes, inlets, cleanouts, fittings and accessories.

1.2. RELATED SECTIONS

A. Section 31 23 19.00 – Dewatering

B. Section 33 05 22.00 – Utility Trenching and Backfilling

1.3. MEASUREMENT PROCEDURES

A. Storm Sewer Main:

1. Measure by distance in lineal feet.

2. Measure from centerline of manhole to centerline of manhole or end of pipe size specified.

3. Do not measure through end sections.

B. Manholes:

1. Measure by height (vertical distance) in vertical feet.

2. Measure from invert (flow line) of lowest outgoing pipe to top of manhole casting.

C. Inlet and Catch Basin Leads:

1. Measure by distance in lineal feet.

2. Measure from centerline of manhole to centerline of inlet (catch basin) or from centerline of inlet (catch basin) to centerline of inlet (catch basin).

D. Storm Sewer Laterals:

1. Measure by distance in lineal feet.

2. Measure from outer wall of storm sewer main to end of storm sewer lateral.

E. Endwalls & Outfall Structures:

1. Measure on an each basis.

F. Inlets & Catch Basins

1. Measure on an each basis.

2. Include structure, adjusting rings and casting as one unit.

G. Cleanouts:

1. Measure on an each basis.

2. Include wye, bends and cleanout cover as one unit.

1.4. REFERENCES

A. AASHTO M-36 - Corrugated Steel Pipe, Metallic-Coated, For Sewers & Drains.

B. AASHTO M-167 - Corrugated Steel Structural Plate, Zinc-Coated, For Field-Bolted Pipe, Pipe-Aches & Arches.

C. AASHTO M-190 - Bituminous Coated Corrugated Metal Culvert Pipe & Pipe-Arches.

D. AASHTO M-198 - Joints For Concrete Pipe, Manholes & Precast Box Sections Using Preformed Flexible Joint Sealants.

E. AASHTO M-294 - Corrugated Polyethylene Pipe, 300 to 1200-mm Diameter.

F. ASTM C-76 - Standard Specification For Reinforced Concrete Culvert, Storm Drain & Sewer Pipe.

G. ASTM C-443 - Standard Specification For Joints For Concrete Pipe & Manholes, Using Rubber Gaskets.

H. ASTM C-478 - Standard Specification For Precast Reinforced Concrete Manhole Sections.

I. ASTM C-507 - Standard Specification For Reinforced Concrete Elliptical Culvert, Storm Drain & Sewer Pipe.

J. ASTM C-655 - Standard Specification For Reinforced Concrete D-load Culvert, Storm Drain & Sewer Pipe.

K. ASTM D-471 - Standard Test Method For Rubber Property - Effect Of Liquids.

L. ASTM D-1784 - Standard Specification For Rigid Poly(Vinyl Chloride)(PVC) Compounds & Chlorinated Poly(Vinyl Chloride)(CPVC) Compounds.

M. ASTM D-2321 - Standard Practice For Underground Installation Of Thermoplastic Pipe For Sewers & Other Gravity-Flow Applications.

N. ASTM D-3034 - Standard Specification For Type PSM Poly(Vinyl Chloride)(PVC) Sewer Pipe & Fittings.

O. ASTM D-3212 - Standard Specification For Joints For Drain & Sewer Plastic Pipes Using Flexible Elastomeric Seals.

P. ASTM D-3350 - Standard Specification For Polyethylene Plastics Pipe & Fittings Material.

Q. ASTM F-477 - Standard Specification For Elastomeric Seals (Gaskets) For Joining Plastic Pipe.

R. ASTM F-679 - Standard Specification for Poly(Vinyl Chloride)(PVC) Large Diameter Plastic Gravity Flow Sewer Pipe & Fittings.

S. ASTM F-794 - Standard Specification For Poly(Vinyl Chloride)(PVC) Profile Gravity Sewer Pipe & Fittings, Based On Controlled Inside Diameter.

T. ASTM F-949 - Standard Specification For Poly(Vinyl Chloride)(PVC) Corrugated Sewer Pipe With A Smooth Interior & Fittings.

U. ASTM F-2736 – Standard Specification for 6 to 30 In. Polypropylene (PP) Corrugated Single Wall and Double Wall Pipe

V. ASTM F-2881 – Standard Specification for 12 to 60 In. Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications

1.5. SHOP DRAWINGS

A. Supply shop drawings for manholes, catch basins, inlets, castings, lateral connections and all other appurtenances.

1. Submit a minimum of four (4) sets of shop drawings.

1.6. QUALITY ASSURANCE / CONTROL SUBMITTALS

A. Submit manufacturer’s test report.

B. Submit Certificate Of Conformance signed by authorized agent of the manufacturer or supplier.

1.7. CLOSEOUT SUBMITTALS

A. Record Drawings:

1. Submit one (1) set of record drawings to ENGINEER at completion of project.

2. Prepare record drawings by marking up a set of drawings showing all changes from the original drawings.

3. Show underground exterior sewers, underground interior sewers, gas lines, water lines, electrical conduit, telephone cable, and any other underground facilities encountered during construction.

4. Keep record drawings in a clean location during construction.

5. Show the following measurement on the record drawings:

   a. Length between manholes, based upon center of castings.

   b. Manhole depths, rim to invert, and any other pipe elevations within the manhole.

   c. Length of lateral, measured horizontally from the outer wall of the sewer main to the end of the lateral pipe.

   d. Lateral location, measured from center of downstream manhole to wye or tee.

   e. Length of riser, measured from the outer wall of the sewer main to the bend point.

   f. Depth of lateral at the property line, measured from the top of the pipe to the ground elevation (preferably sidewalk or curb).

   g. Inlet locations, station, and offset.

   h. Inlet lead length, based upon center of castings.

1.8. DELIVERY, STORAGE & HANDLING

A. Receiving & Storing Pipe & Accessories:

1. Check all pipe and accessories for loss or damage in transit when received from the carrier and at the time of unloading.

2. Check all pipe for proper identification markings as required for the specific material and that the pipe and accessories delivered to the site meet the appropriate material specifications.

3. Reject delivered pipe and accessories until Items 1. and 2. (above) have been satisfied.

4. Store pipe and accessories in accordance with the storage requirements and recommendations of the manufacturer.

5. Unload and distribute pipe and accessories using adequate and proper equipment so as not to damage the material.

6. Remove material not meeting specifications or found to have cracks, flaws or other defects by the CONTRACTOR, ENGINEER or OWNER.

PART 2 - PRODUCTS

2. 1 MATERIALS - SEWER PIPE

A. Polyvinyl Chloride (PVC) SDR Pipe SDR 35 & Fittings:

1. Conform To:

a. ASTM D-3034 - Standard Specification For Type PSM Poly(Vinyl Chloride)(PVC) Sewer Pipe & Fittings.

b. ASTM D-3212 - Standard Specification For Joints For Drain & Sewer Plastic Pipes Using Flexible Elastomeric Seals.

c. ASTM F-477 - Standard Specification For Elastomeric Seals (Gaskets) For Joining Plastic Pipe.

2. Deliver pipe and fittings marked as follows (pipe marked every 5 feet or less):

a. Manufacturer's name or trademark.

b. Nominal pipe size.

c. The PVC cell classification, e.g., 12454.

d. The legend "SDR-35 PVC Sewer Pipe".

e. ASTM Designation D-3034.

3. Deliver all pipe and fittings on any one (1) project from one (1) manufacturer.

4. Acceptable Pipe Sizes: 4-inch through 15-inch.

B. Reinforced Concrete Pipe:

1. Conform To:

a. ASTM C-76 - Standard Specification For Reinforced Concrete Culvert, Storm Drain & Sewer Pipe.

b. ASTM C-443 - Standard Specification For Joints For Concrete Pipe & Manholes, Using Rubber Gaskets.

c. ASTM C-507 - Standard Specification For Reinforced Concrete Elliptical Culvert, Storm Drain & Sewer Pipe.

d. ASTM C-655 - Standard Specification For Reinforced Concrete D-Load Culvert, Storm Drain & Sewer Pipe.

e. ASTM D-471 - Standard Test Method For Rubber Property - Effect Of Liquids.

2. Deliver pipe and fittings marked as follows (pipe marked every 5 feet or less):

   a. Class of pipe.

   b. Nominal pipe size.

   c. Date of manufacture.

   d. Name or trademark of the manufacturer.

3. Deliver all pipe and fittings on any one (1) project from one (1) manufacturer.

4. Acceptable Pipe Sizes: All sizes.

5. Acceptable Pipe Classes: Class III or greater.

6. Cure pipe no less than 7-days prior to incorporation into the work.

7. Joints:

   a. Rubber O-ring type gaskets conforming to the requirements of ASTM C-443.

8. Fittings & Connections:

   a. Precast fittings unless otherwise specified in the Special Provisions.

9. Inspection & Rejection:

   a. Inspect pipe at the job site. ENGINEER may also inspect pipe.

   b. Reject Pipe Due To Any Of The Following:

      1) Variations in any dimensions exceeding that allowed in the ASTM standard.

      2) For bell and spigot pipe, fractures or cracks passing through the barrel or socket, except that a single crack not exceeding 2-inches in length at either end of pipe or a single fracture in the socket not exceeding 3-inches in width nor 2-inches in length shall not be considered cause for rejection unless these defects exist in more than 5% of the entire shipment or delivery. For tongue and groove pipe, fractures or cracks through the barrel except for a single crack that does not exceed the depth of the joint and can be effectively sealed.

3) Blisters where the surface is broken or which project more than 1/8-inch above the surface.

4) Defects that indicate imperfect proportioning, mixing and molding.

5) Surface defects indicating honeycombing or open texture.

6) Cracks sufficient to impair the strength, durability or serviceability of the pipe.

7) Damaged ends, where such damage would prevent making a satisfactory joint.

8) Variation of more than 1/8-inch per lineal foot in alignment of pipe intended to be straight.

9) Failure to give a clear ringing sound when placed on end and dry-tapped with a light hammer.

10) Insecure attachment of spurs on branches and fittings.

11) The complete absence of distinct web-like markings from the external surface of the pipe made by any process in which the forms are removed immediately after the concrete has been placed, which is indicative of a deficiency of water in the concrete mix, unless all specimens submitted for test that do not have such web-like markings have passed the physical tests required by the specifications.

c. Stamp rejected pipe "Rejected".

d. Do not deface or otherwise damage pipe.

e. Replace all rejected pipe with pipe that conforms to ASTM Standards at no expense to OWNER.

2. 2 MANHOLES

A. Conform To:

1. AASHTO M-198 Joints for Concrete Pipe, Manholes & Precast Box Sections Using Preformed Flexible Joint Sealants.

2. ASTM C-443 - Standard Specification For Joints For Concrete Pipe & Manholes, Using Rubber Gaskets.

3. ASTM C-478 - Standard Specification For Precast Reinforced Concrete Manhole Sections.

B. Precast Manhole Sections:

1. Acceptable joints and gaskets.

2. Rubber gaskets conforming to ASTM C-433.

3. An approved butyl joint sealant meeting the requirements of AASHTO M-198.

4. Reject gaskets, if they show surface checking, weathering or other deterioration prior to installation.

5. Acceptable Manhole Steps:

   a. Specified on the Contract Drawings or in Special Provisions.

6. Acceptable adjusting rings.

7. Precast Concrete:

   a. Manhole base section.

   b. Integrally cast bottom and barrel section.

   c. Factory manufactured invert.

   d. Field constructed invert.

   e. Appropriate opening sizes to accept sewer pipes.

C. Inspection & Rejection:

1. Inspect manhole sections and cones upon arrival at job site.

2. Reject Manhole Sections & Cones For Any Of The Following Reasons:

   a. Fracture or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.

   b. Defects that indicate imperfect proportioning, mixing and molding.

   c. Surface defects indicating honeycombed or open texture.

   d. Damaged ends, where such damage would prevent making a satisfactory joint.

   e. Manhole steps out of line or not properly spaced.

   f. Internal diameter of the manhole section varying more than 1% from the nominal diameter.

g. Any continuous crack having a surface width of 0.01-inch or more and extending for a length of 12-inches or more, regardless of position in the section wall.

D. Manhole Castings:

1. Furnish and install manhole casting type specified in the detail drawings or in the Special Provisions.

E. Pipe To Manhole Connections:

1. Flexible pipe to manhole connections are not required.

2. Water stops required on all plastic pipe.

2. 3 CATCH BASINS & INLETS

A. Definition:

1. Inlet: A stormwater inlet of precast construction without a sump.

2. Catch Basin: A stormwater inlet of precast construction having a sump.

3. The detail and size of the inlet or catch basin are specified on the Contract Drawings or Special Provisions.

2. 4 SEWER SERVICE LATERALS

A. Connections To New Sewers:

1. Connect using in-line wyes or tees factory fabricated of the same material as the sewer main.

2. Provide wyes with the proper bend to permit laying of the lateral at right (90°) angles to the sewer main.

B. Connections To Existing Sewers:

1. PVC Sewer Main:

a. PVC water-proof saddles of the same pipe composition and brand as the existing sewer main.

b. Provide stainless steel bands on each side of the saddle.

2. Concrete, Asbestos Cement Or Vitrified Clay Sewer Main:

a. Saddle Connection:

1) Cast iron or aluminum saddles.

2) Provide stainless steel bands on each side of the saddle.

b. Rubber Boot Connection:

1) Conform to ASTM C-443.

2) Submit a shop drawing of the connection materials prior to installation.

3. Other Materials Main:

a. Submit the proposed fitting material to be used for lateral connections the ENGINEER for review prior to installation.

C. Lateral Pipe and Fittings:

1. Conform to Section 2.1, Materials - Sewer Pipe.

PART 3 - EXECUTION

3.1. INSTALLATION - SEWER PIPE

A. General Requirements:

1. Related Section:

a. Section 33 05 22.00 – Utility Trenching and Backfilling.

2. References:

a. ASTM D-2321 - Standard Practice For Underground Installation Of Thermoplastic Pipe For Sewers & Other Gravity-Flow Applications.

3. Lower all pipe, fittings and accessories into the trench in such a manner as to prevent damage to the materials.

4. Do not drop or dump materials into the trench. Clean foreign matter or dirt from within the pipe before installation.

5. Install pipe to uniform line and grade. Reject work with noticeable variations from true alignment and grade. Insert pipe to ensure that the entering pipe is forced tightly against the last pipe installed. Hold pipe firmly in place while backfill is being placed around the pipe in order to ensure against any movement from true alignment or grade.

6. Install pipe starting at the lowest point in the proposed sewer line. Install pipe with the bell end of the bell and spigot pipe or with the receiving groove end of tongue and groove pipe pointing upgrade. Install pipe so that each pipe rests upon the full length of its barrel with holes excavated to accommodate bells where bell and spigot are used.