SCHULTZ

May 20, 2014

State of Vermont Agency of Transportation
Southwest Regional Construction Office
61 Valley View
Mendon, VT 05701

Attn: Chris Williams, P.E.

Re: ***Rochester BRF 0162(16) & BRF 0162(17) & ER BRF 0162(18) & STP BRF 0162(19)***
Nighttime Operations & Lighting Plan – Bridge 19

Dear Mr. Williams:

During the course of construction the need for night time operations at bridge 19 could arise. Pursuant to the specifications, enclosed is a nighttime operations & lighting plan for your review and approval. It is our intention to light the work area in accordance with NCHRP Report 476 (as called for in the project special provisions) through the use of the following methods:

1) Please see the attached plan sheets showing the approximate locations of light towers and the radius they can maintain Level II illumination (10 foot candles) for bridge 19. Towers have an operating height of 30ft and will be spaced in order for the jobsite to maintain an average intensity of 10 foot-candles per manufactures recommendations this spacing is such that the illuminated range of one light tower is overlapped by approximately half by the adjacent light tower, approximately 100ft spacing will achieve this.
2) Light towers will be Allmand Nite-Lite Pro (or equal), operated with diesel fuel.
3) Please see attached cut sheet of the Allmand Nite-Lite Pro.
4) Lights will be pointed towards the ground and positioned at the highest mast height possible (30 ft) in order to minimize glare.
5) All equipment to be used is equipped with manufacturer lighting; no additional lights will be mounted to equipment.
6) Please see the attached lighting calculations and established industry standards.

All lighting equipment will be inspected on a daily basis and repairs and/or replacements will be made prior to the next night. Also, in accordance with the NCHRP Report 476, a test inspection of the lighting system will be performed with the E.I.C. prior to the start of nighttime operations and

adjustments required will be made prior to the start of work. Please note that this plan is submitted based upon off site activity plans, traffic control plans, etc that are being submitted/reviewed under separate cover. Should any of those plans not be approved in the version this lighting plan is based upon, the lighting plan will be revised to reflect changes made. Please review and advise of any revisions the agency has upon completion of your review. Thank you.

Very Truly Yours,
WM Schultz Construction, Inc.

Mike Garn
Assist. Project Manager

PO Box 2620 • Ballston Spa, NY 12020 • Ph 518.885.0060 • Fx 518.885.0744 • www.wmschultz.com

and avoid this area during setup and takedown. Lighting need not be required throughout the entire lane closure, except as required at active work sections (*41*).

Whether or not the taper should be lit at times other than setup and takedown depends, in part on the lighting characteristics of the sections adjacent to the taper. The concern here is the possible creation of a transient adaptation effect. That is, as a driver traverses a brighter section of roadway, the eye adapts to that illumination level. Upon going into a darker area, it takes the eye a short period of time to adapt to the lower level of illumination. During the adaptation period, the visibility of objects is reduced. Because, as mentioned, the taper is a transitional area for the driver, any situations that produce reduced visibility should be avoided (*42*).

- **Level II.** This level of illuminance is recommended for areas on or around construction equipment. This level of minimum illuminance is necessary both for safety in operating equipment and for attaining an acceptable level of accuracy. Asphalt paving, milling, and concrete placement and removal are examples.
- **Level III.** This level of illuminance is suggested for tasks requiring a higher level of visual performance or for tasks with a higher level of difficulty. Pavement or structural crack and pothole filling, joint repair, pavement patching and repairs, installation of signal equipment or other electrical or mechanical equipment, and other tasks involving fine details or intricate parts and equipment require Level III illuminance.

2.9.2 Illumination Criteria

Luminaires should be of sufficient wattage and quantity to provide an average maintained illuminance equal to or greater than the following:

- Level I: 59 lux (5 footcandles),
- Level II: 108 lux (10 footcandles), and
- Level III: 215 lux (20 footcandles).

Although most tasks require maintenance of horizontal illumination, some tasks (such as bridge painting, concrete and steel repairs on bridges, and work on overhead signs and sign structures) require that vertical illuminance be maintained.

Horizontal illumination refers to measurements made with the photocell parallel to the road surface. For purposes of roadway lighting, the photocell is placed on the pavement. Vertical illumination refers to measurements made with the photocell perpendicular to the road surface. Vertical measurements require that the direction and the height above ground be specified. See Tech Note 47.

2.9.3 Paving and Milling Operations

For paving and milling operations, including bridge decks, New York State requires Level II illuminance 15 m (50 ft) ahead of and 30 m (100 ft) behind the paving or milling machine. Although these distances have been found appropriate by New York, other distance boundaries may be acceptable (*41*).

In addition, New York State recommends Level I illuminance for a minimum of 120 m (400 ft) ahead of and 245 m (800 ft) behind the paving or milling machine, or for the entire area of concrete placement or pavement work if less than this distance. This area is extended as necessary to incorporate all vehicle and equipment operations associated with the paving operation. The only exception to the requirement for Level I illuminance throughout the area of construction operations is that finish rollers will work beyond the area of Level I illuminance using floodlights mounted on the roller. This exception is necessary because, given the length of time pavement may take to cool, the finish roller may drop farther than 245 m (800 ft) behind the paver (*41*).

In the night paving project in Figure 28, portable light towers throughout the work area provide Level I illumination. Floodlights on the paver and rollers supplement the towers to provide Level II illumination at the paving operation.

The New Jersey DOT has developed specifications to mount luminaires on paving equipment to achieve Level I and II illumination. The DOT reports good results with equipment-mounted lighting to meet these levels (*43*).

2.9.4 Uniformity

The uniformity of illuminance, defined as the ratio of the average illuminance to the minimum illuminance over the work area, should not exceed 10:1, with 5:1 being more desirable (*38, 41*).

2.9.5 Glare

The eye reacts in two distinct ways to the presence of glare. One reaction is described as discomfort glare. This reaction is

Figure 28. Level I and II illuminance at a nighttime paving project.

Allmand™

Night-Lite PRO™

Eclipse®

Maxi-Lite®

TLB™

Night-Lite Pro

Port-A-Lite™

Maxi-Heat®

- **SHO-HD lamp fixture with standard 1250 watt system produces 150,000 lumens per lamp**
- **30 gallon fuel capacity allows up to 60 hours continuous operation without refueling**
- **12 light towers per truckload reduces transportation costs**

Brighter. Warmer. Safer.

Reliability, performance, and integrity since 1938

ALLMAND ASSURANCE

SHO-HD NIGHT-LITE PRO

SPECIFICATIONS

Engine: Liquid-cooled diesels operating at 1800 rpm including:
Kohler KDW 1003 13.4 hp (7.5kW generator)
Kubota D-1005 BG 13.1 hp (7.5 kW generator)
Kubota D-1105 BG 13.6 hp (8 kW generator)
Caterpillar C1.1 14.3 hp (8 kW generator)
Low oil pressure / high temperature automatic shutoff standard

Starting: 12 volt electric
Glow plug cold starting system

Fuel Capacity: 30 gal. (114 L)

Operating Time: Up to 65 hrs. without refueling

Lighting: 4-1250 watt metal halide fixtures
Initial output of 150,000 lumens per lamp

Electrical: Alternator (Generator): 60 Hz, 1-phase
Circuits: Hard-wired electrical
Ballast: Easily serviceable, "componetized" assemblies
120 VAC duplex GFCI convenience outlet
Ground Rod

Tower: 30 ft. heavy-duty three-section tower;
Self-lubricating nylon wear pads
Rotation: 360° rotatable from the ground

Trailer: Frame: Formed, welded steel
Adjustable height, reversible combination 2" (50mm) ball coupler and 3" (75mm) pintle towing hitch
Heavy-duty enclosure with 10-gauge side panels and 12-gauge hood
Lockable, 12-gauge lift-up access doors
Stop / Turn / Tail Lights
Forklift pockets and lifting eye
Tie down rings

Stabilizers: Three-point design
Tower center-mounted between two retractable rear outriggers and tongue jack
Remains operational in wind gusts up to 65 mph (104.6 kph)

Domestic Shipping Weight:
Light Fixtures: 15 lbs. (6.8 kg) (each)
Trailer and Mast: 1,540 lbs. (699 kg)
Total Weight: Approx. 1,600 lbs. (726 kg)

DIMENSIONS

Height mast lowered: 6 ft. 1 in. (1.9 m)
Height mast raised: 30 ft. (9.1 m)
Length with fixtures: 13 ft. 6 in. (4.0 m)
Width: 4 ft. 1.5 in. (1.3 m)
Outrigger Width: 7 ft. 9.5 in. (1.24 m)
Wheels and Tires: 13 in.

VALUE-ADDED FEATURES

SHO-HD (super high output-high definition) parallel lamp fixtures provide over 50% more lumens per fixture than competitive light towers. An optional Saf-T-Visor attachment directs otherwise wasted light onto the worksite.

Engine package includes either a Kohler, CAT or Kubota 1,800-rpm liquid-cooled diesel engine

Captive latch on tower support and outriggers eliminates potential for lost pins.

Forklift Pockets and Lift ng Eye allow easy loading and unloading of up to 12 units on a flatbed truck.

30-gallon molded polyethylene fuel tank reduces the chance of contamination from rust and corrosion associated with metal. Provides approximately 65 hours of continuous operation.

OPTIONS

Saf-T-Visor™
Electric Winch
240 Volt, 30 amp receptacle
Tower Cord Reel
Sound attenuation Package
Arctic models available
CSA models available
International models available
LSC100™ automatic light tower control system
Heavy Duty Battery
7-Pole Taillight Connector

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Outdoor Lighting Rules of Thumb

The primary role of outdoor lighting is to expand the productive, educational, cultural and recreational opportunities for man by transforming his static nighttime surroundings into a functioning environment.

The specific functions outdoor lighting provides can be summarized in six words:

SAFETY
SECURITY
ATTRACTION
IDENTIFICATION
BEAUTIFICATION
UNIFICATION

Good lighting design can achieve all six functions at once and represents the most successful outdoor lighting.

I. Rules of Thumb for Area Lighting

A. To produce a maintained level of 5.0 foot-candles over a large area, the following watts per square foot will be required:

	5.0 FC	3 FC	1 FC	.5 FC
High Pressure Sodium	0.12	.072	.024	.012
Metal Halide	0.16	.09	.032	.016
Mercury Vapor	0.25			
Incandescent	0.75			

B. Lighting poles should be spaced not more than 4 times the mounting height of their luminaires apart from one another. Wider spacing will create glare and/or dark areas between poles.

II. Rules of Thumb for Safety and Security Lighting

A. Use a floodlighting approach wherever appropriate to provide maximum visibility of structures and an illuminated backdrop for silhouetting people and objects.

B. Locate and aim floodlights away from workers' and watchmens' normal viewing directions and toward areas to be watched.

C. To achieve apparent uniformity of illumination on a target plane, space luminaires so that half of each luminaire's beam pattern overlaps half of the pattern (angular distribution) from the immediately adjacent units. Equipment should be aimed so as to keep maximum to minimum illumination range less than 5 to 1 on the same plane.

D. Use high intensity discharge sources, where larger packages of light are needed and where lower overall costs and long life are important. Use incandescent sources only for small highlighting, low initial cost, where small packages of light are required, and where short lamp life and high energy draw can be tolerated.

E. Lighting cannot be expected to light out away from a building more than twice the mounting height of the equipment above the ground without producing excessive glare.

III. Rules of Thumb for Attention and Identification Lighting

A. Create contrast in brightness to make signs, dangerous areas, entrances, exits, roads, buildings or other structural elements visually prominent.

Outdoor Lighting Rules of Thumb

B. While sufficient contrast is necessary to achieve prominence, excessive contrast or brightness within the immediate surroundings can be glaring and uncomfortable, and even hazardous to motorists as well as restrictive to security surveillance.

C. Brightness differences from 10 to 100 times as bright as the surroundings are required to achieve visual prominence, and can be achieved without being visually disturbing. High brightness, such as from head-on views of projector luminaires or lamps, can be annoying or even temporarily "blinding".

IV. Rules of Thumb for Work Areas

A. In open areas, position luminaires at the highest practical locations to minimize glare. Aim fixtures down, when possible, and horizontally only when workmen will have their backs to the light sources. Use on-site hoisting equipment when feasible to gain aerial access.

B. Use most efficient and largest wattage lighting equipment practicable for minimum number of fixtures and reduced operating and servicing costs.

C. Congested or physically divided sites will require larger numbers of smaller fixtures or portable lighting equipment to cover all work areas with minimized shadows. Any large opaque surface or object, whether a part of a structure, high stacked material or construction equipment itself, can cause shadows.

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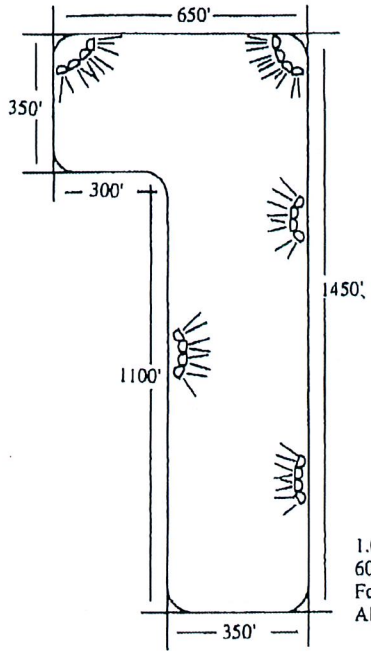
Allmand™ Lighting Variations

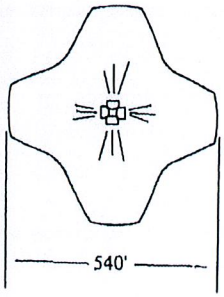
Various Areas Lighted and Number of Lights Required

We show values at darkest edge, not up to a given value.

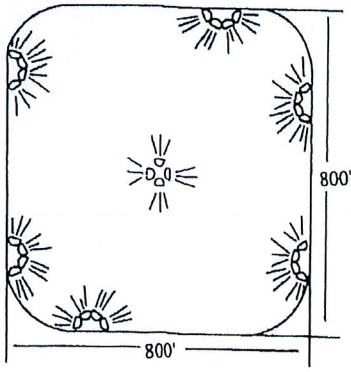
Values are based on best photometric data available, using all 1,000 watt multi-vapor lamps in an Allmand reflector type enclosed fixture.



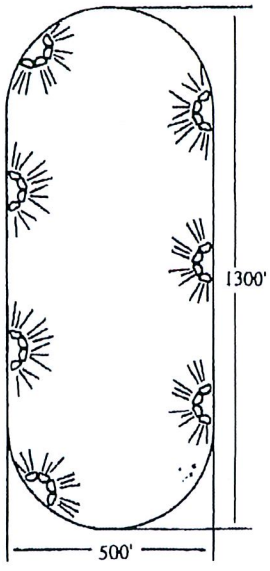
1.0 Foot-Candles
600,000 Sq. Ft. Lighted to 1.0 Foot-Candles with just five Allmand Maxi-Lite III's.



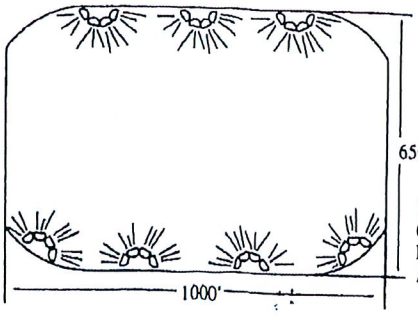
1.0 Foot-Candles
145,800 Sq. Ft. Lighted to 1.0 Foot-Candles with just one Allmand Maxi-Lite III.



1.00 Foot-Candles
640,000 Sq. Ft. Lighted to 1.0 Foot-Candles with just seven Allmand Maxi-Lite III's.



1.0 Foot-Candles
650,000 Sq. Ft. Lighted to 1.0 Foot-Candles with just seven Allmand Maxi-Lite III's.



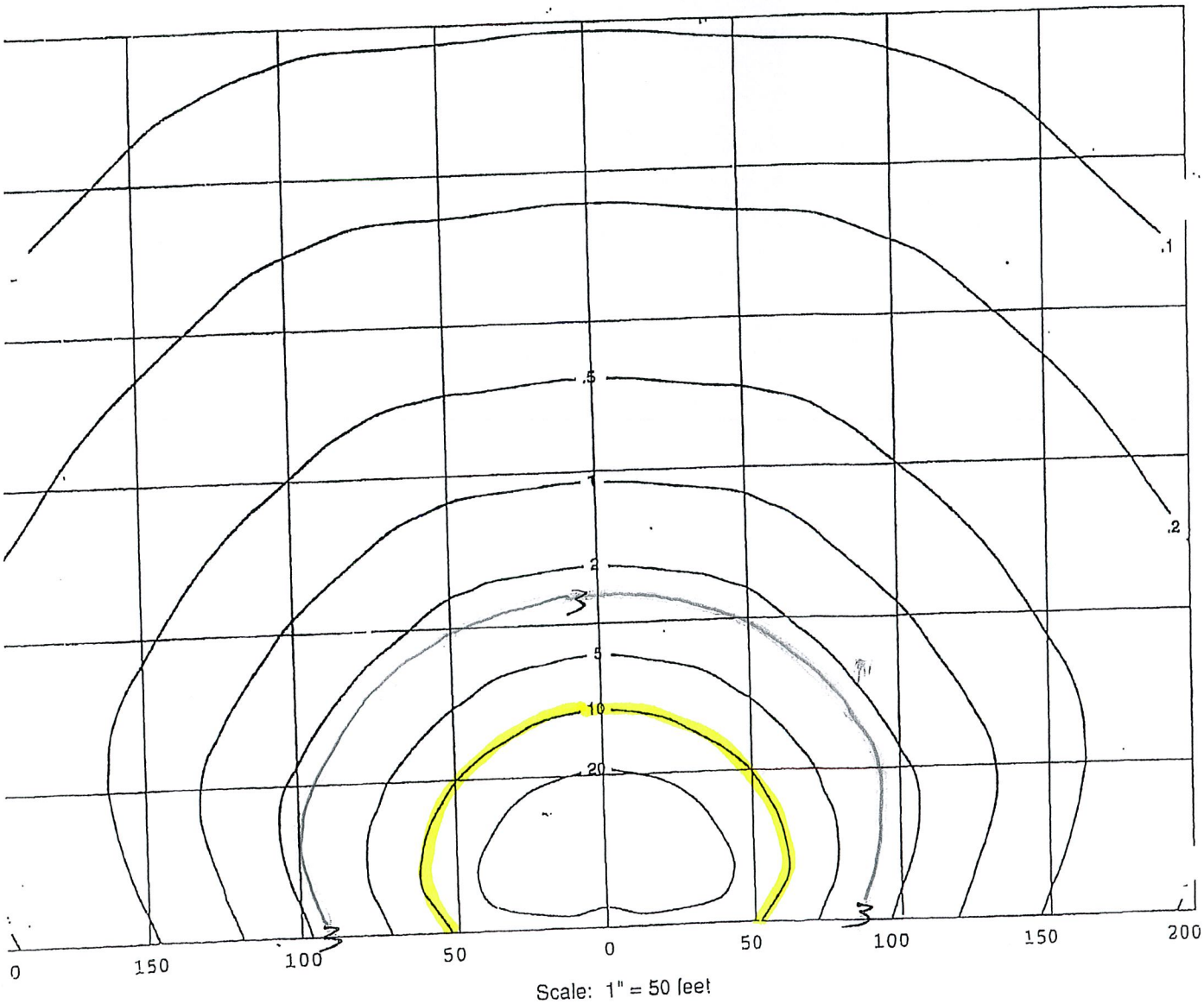
1.0 Foot-Candles
650,000 Sq. Ft. Lighted to 1.0 Foot-Candles with just seven Allmand Maxi-Lite III's.

(NOTE: Light pattern shapes are subject to direction lamps are aimed.)

Allmand™

Independent Testing Laboratories Measurements

Light Fixture: Allmand SHO
Light Source: 1250-watt metal halide (BT-37)
4 Floodlights aimed 45° apart, 30 feet above ground and 20° below the horizon
Lumen output of lamp itself: 140,000
Square feet lighted to .5 foot candle-48,672
Manufacturers using this fixture: Allmand



Scale: 1" = 50 feet

BASED ON PUBLISHED INDUSTRY PROCEDURES. FIELD PERFORMANCE MAY DIFFER FROM LABORATORY PERFORMANCE.

UNITED STATES DEPARTMENT OF LABOR
OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION

Regulations (Standards - 29 CFR)

Illumination. - 1926.56

Regulations (Standards - 29 CFR) - Table of Contents

- **Part Number:** 1926
- **Part Title:** Safety and Health Regulations for Construction
- **Subpart:** D
- **Subpart Title:** Occupational Health and Environmental Controls
- **Standard Number:** 1926.56
- **Title:** Illumination.

1926.56(a)

General. Construction areas, ramps, runways, corridors, offices, shops, and storage areas shall be lighted to not less than the minimum illumination intensities listed in Table D-3 while any work is in progress:

TABLE D-3 - MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES

Foot-Candles	Area of Operation
5	General construction area lighting.
3	General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: warehouses, corridors, hallways, and exitways.
5	Tunnels, shafts, and general underground work areas: (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines approved cap lights shall be acceptable for use in the tunnel heading)
10	General construction plant and shops (e.g., batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active store rooms, mess halls, and indoor toilets and workrooms.)
30	First aid stations, infirmaries, and offices.

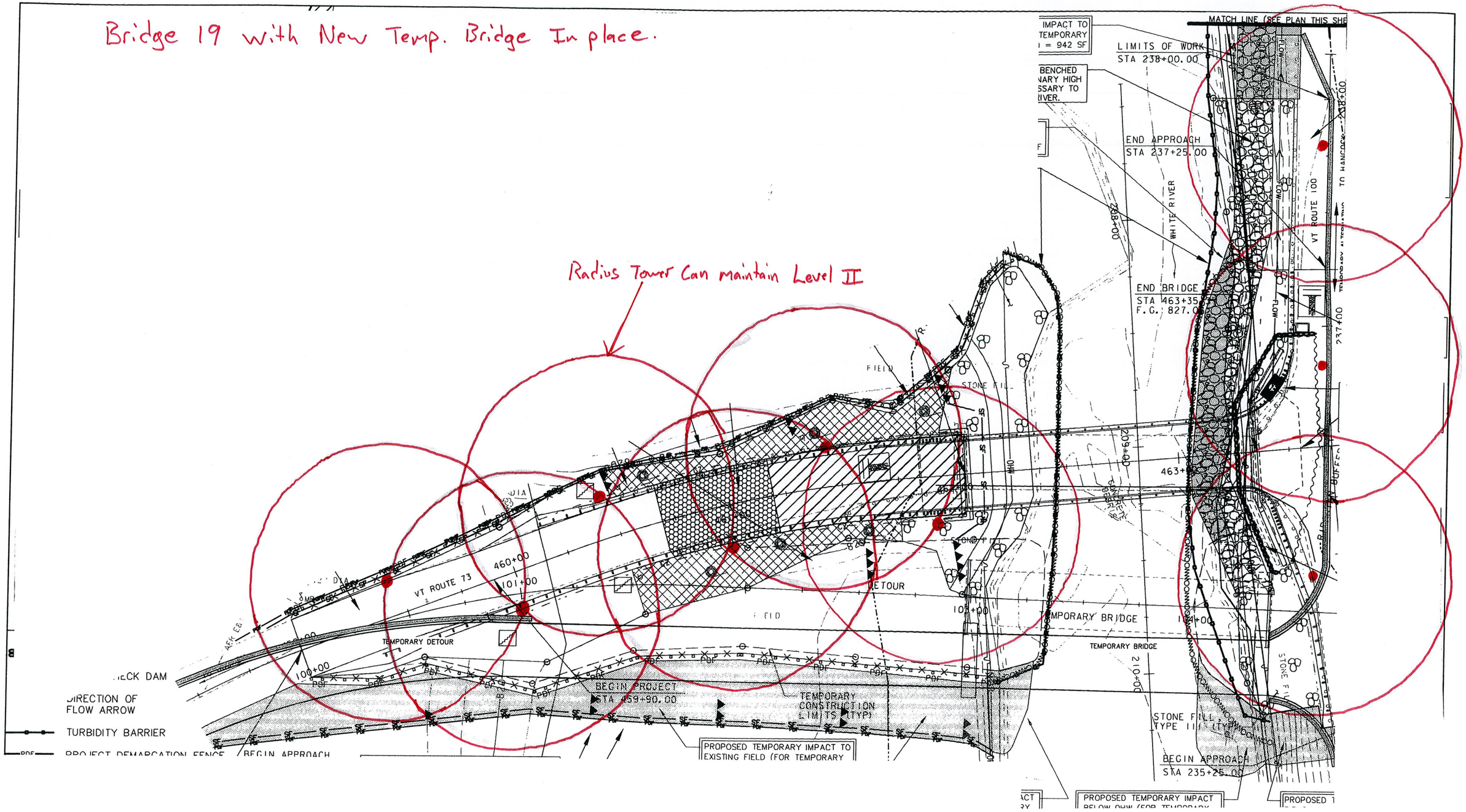
1926.56(b)

Other areas. For areas or operations not covered above, refer to the American National Standard A11.1-1965, R1970, Practice for Industrial Lighting, for recommended values of illumination.

Next Standard (1926.57)

Regulations (Standards - 29 CFR) - Table of Contents

Bridge 19 with New Temp. Bridge Inplace.



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