

## **Session 55**

**Angel Rodriguez**

FL. Dept. of Transportation

### ***Movable Bridges & Mechanical Electrical Issues***

#### **Topic Description**

Explain changes to the Electrical and Architectural sections of Chapter 8 (Movable Bridges) of the Design Guidelines.

#### **Speaker Biography**

Angel Rodriguez graduated from the University of Puerto Rico in 1974 with a BSEE. He has been with the Department for the last 20+ years working with movable bridges first in Maintenance and now in Design. Previous to working with the Department, he worked for the sugar mill industry, Westinghouse, and the Federal Government.

# MOVABLE BRIDGES

Angel F. Rodriguez, P.E.  
Mechanical/Electrical

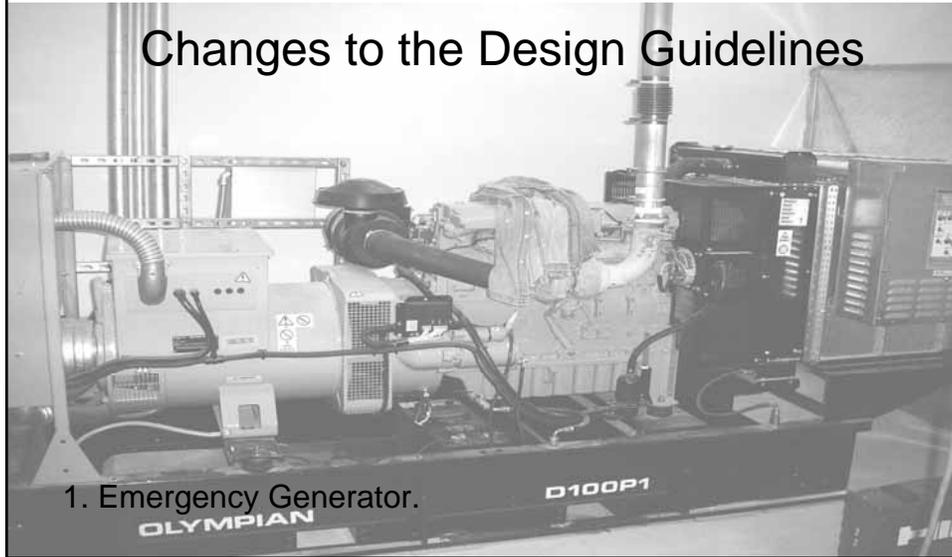
## MOVABLE BRIDGES

Changes  
to the  
Design Guidelines



## MOVABLE BRIDGES

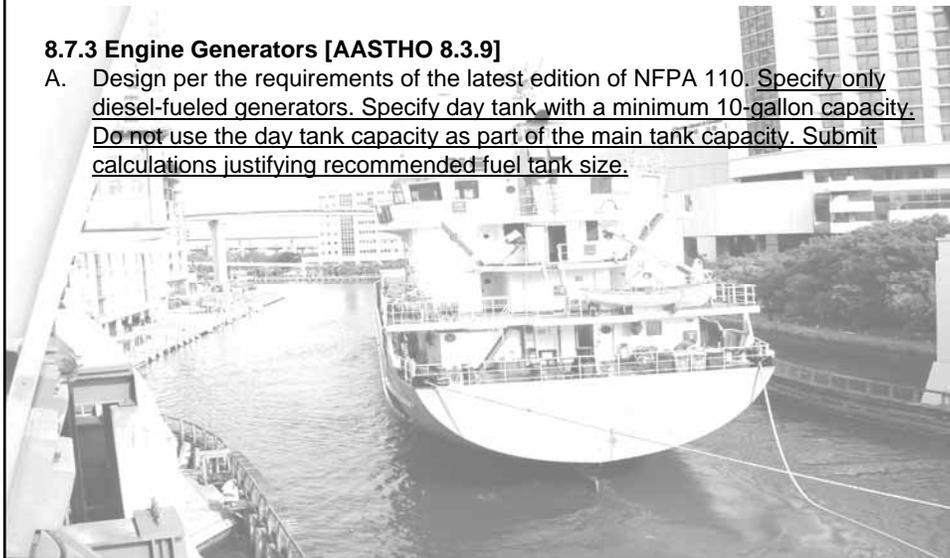
### Changes to the Design Guidelines



## MOVABLE BRIDGES

### 8.7.3 Engine Generators [AASHTO 8.3.9]

- A. Design per the requirements of the latest edition of NFPA 110. Specify only diesel-fueled generators. Specify day tank with a minimum 10-gallon capacity. Do not use the day tank capacity as part of the main tank capacity. Submit calculations justifying recommended fuel tank size.



## MOVABLE BRIDGES

### B. New Bridges:

1. Provide two generators, Main Generator to power leaf drive and House Generator to power "house" loads.

#### Commentary:

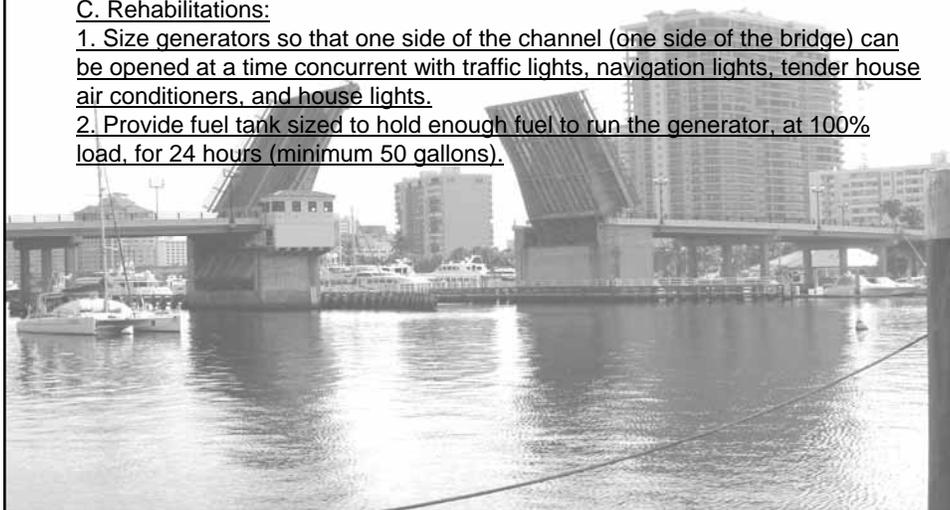
Bridges are requiring bigger generators to operate because of the increase in main drive power requirements. It is not cost effective to run these generators continuously to power miscellaneous loads.

2. Size Main Generator so that one side of the channel (one side of the bridge) can be opened at a time. Main Generator to run during openings only.
3. Size House Generator to power house loads like traffic lights, navigation lights, tender house air conditioner, and house lights. House Generator to run continuously during power outage and is to be inhibited from transferring to the 480 volt bus when the Main Generator is running.
4. Provide fuel tank sized to hold enough fuel to run the Main Generator, at 100% load, for 12 hours and the House Generator, at 75% load, for 72 hours (minimum 50 gallons).

## MOVABLE BRIDGES

### C. Rehabilitations:

1. Size generators so that one side of the channel (one side of the bridge) can be opened at a time concurrent with traffic lights, navigation lights, tender house air conditioners, and house lights.
2. Provide fuel tank sized to hold enough fuel to run the generator, at 100% load, for 24 hours (minimum 50 gallons).



# MOVABLE BRIDGES

## Changes to the Design Guidelines

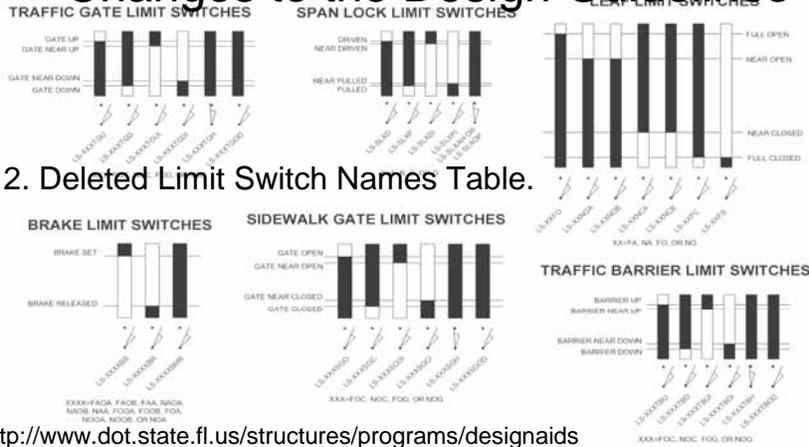
ON-COMING TRAFFIC GATE LIMIT SWITCHES		OFF-GOING TRAFFIC GATE LIMIT SWITCHES	
LS-FOCTGU	Far On-Coming Traffic Gate Up	LS-FOGTGU	Far Off-Going Traffic Gate Up
LS-FOCTGUx	Far On-Coming Traffic Gate Up Interlock	LS-FOGTGUx	Far Off-Going Traffic Gate Up Interlock
LS-FOCTGD	Far On-Coming Traffic Gate Down	LS-FOGTGD	Far Off-Going Traffic Gate Down
LS-FOCTGDx	Far On-Coming Traffic Gate Down Interlock	LS-FOGTGDx	Far Off-Going Traffic Gate Down Interlock
LS-FOCTGH	Far On-Coming Traffic Gate Handcrank Inserted (if used)	LS-FOGTGH	Far Off-Going Traffic Gate Handcrank Inserted (if used)
LS-FOCTGDO	Far On-Coming Traffic Gate Operator Door open	LS-FOGTGDO	Far Off-Going Traffic Gate Operator Door open
LS-NOCTGU	Near On-Coming Traffic Gate Up	LS-NOGTGU	Near Off-Going Traffic Gate Up
LS-NOCTGUx	Near On-Coming Traffic Gate Up Interlock	LS-NOGTGUx	Near Off-Going Traffic Gate Up Interlock
LS-NOCTGD	Near On-Coming Traffic Gate Down	LS-NOGTGD	Near Off-Going Traffic Gate Down
LS-NOCTGDx	Near On-Coming Traffic Gate Down Interlock	LS-NOGTGDx	Near Off-Going Traffic Gate Down Interlock
LS-NOCTGH	Near On-Coming Traffic Gate Handcrank Inserted (if used)	LS-NOGTGH	Near Off-Going Traffic Gate Handcrank Inserted (if used)
LS-NOCTGDO	Near On-Coming Traffic Gate Operator Door open	LS-NOGTGDO	Near Off-Going Traffic Gate Operator Door open

2. Deleted Limit Switch Names Table.

LIMIT SWITCHES

# MOVABLE BRIDGES

## Changes to the Design Guidelines

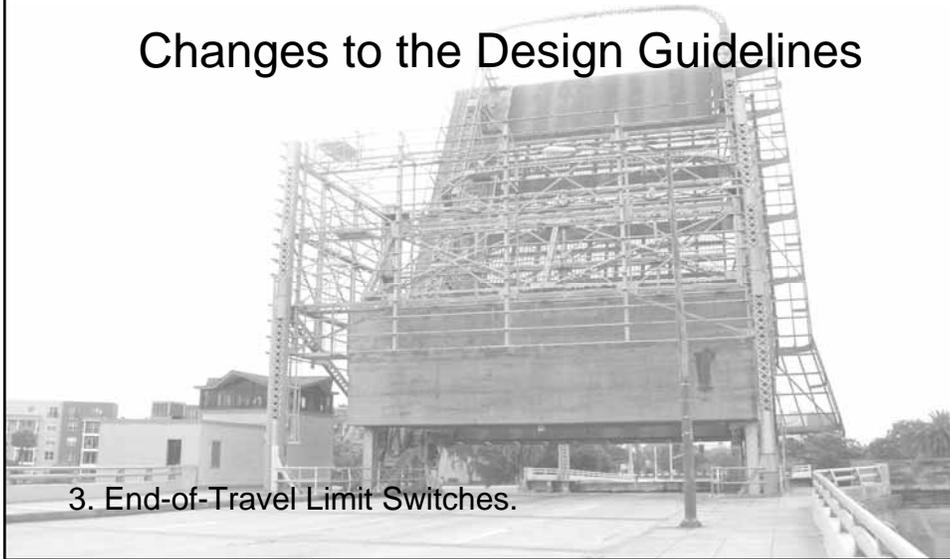


<http://www.dot.state.fl.us/structures/programs/designaids>

LIMIT SWITCH DEVELOPMENT

# MOVABLE BRIDGES

## Changes to the Design Guidelines

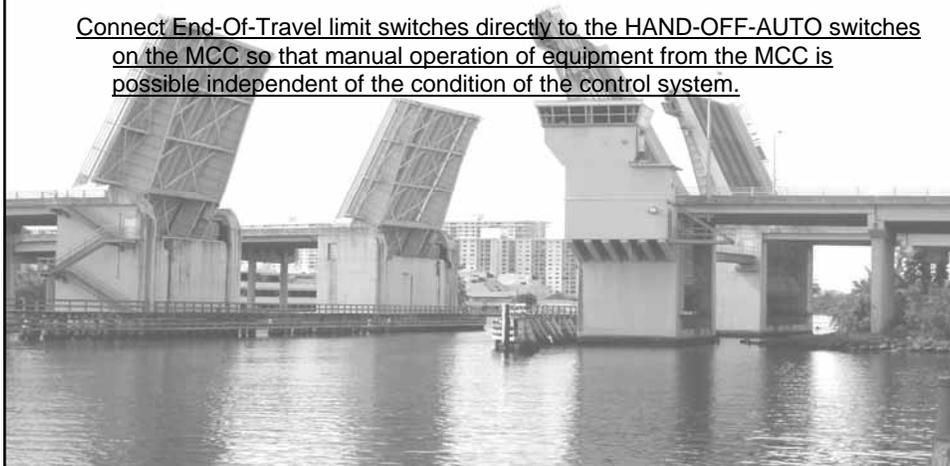


3. End-of-Travel Limit Switches.

# MOVABLE BRIDGES

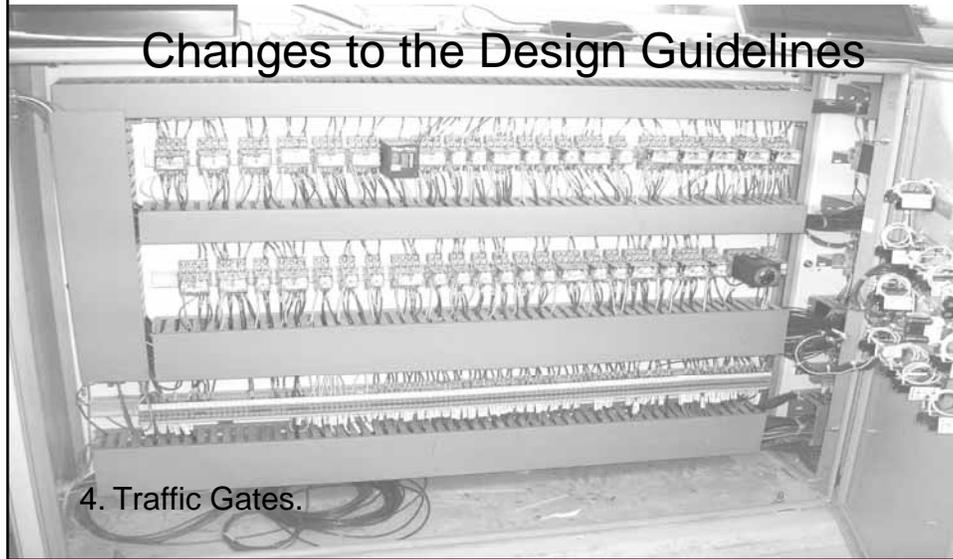
Added to 8.7.8 Limit and Seating Switches [AASHTO 8.4.1]:

Connect End-Of-Travel limit switches directly to the HAND-OFF-AUTO switches on the MCC so that manual operation of equipment from the MCC is possible independent of the condition of the control system.



## MOVABLE BRIDGES

### Changes to the Design Guidelines



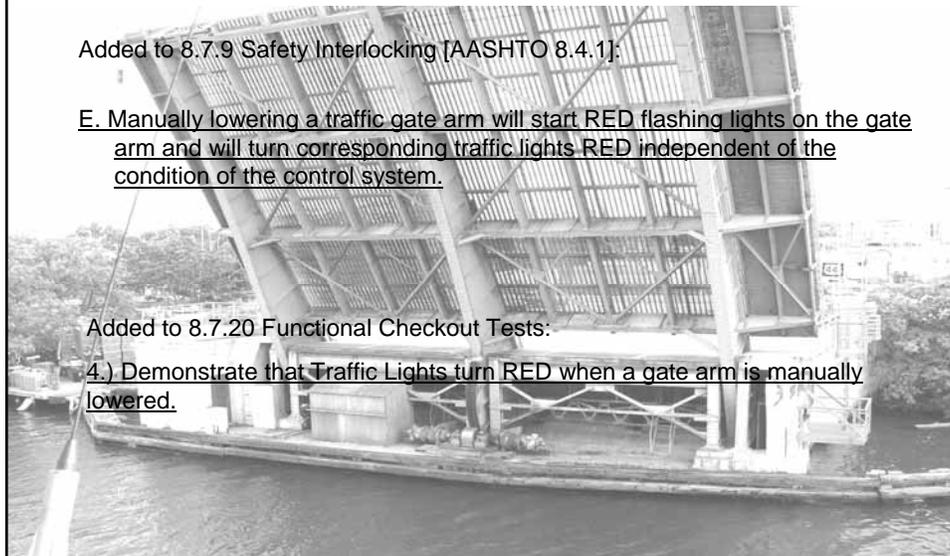
## MOVABLE BRIDGES

Added to 8.7.9 Safety Interlocking [AASHTO 8.4.1]:

E. Manually lowering a traffic gate arm will start RED flashing lights on the gate arm and will turn corresponding traffic lights RED independent of the condition of the control system.

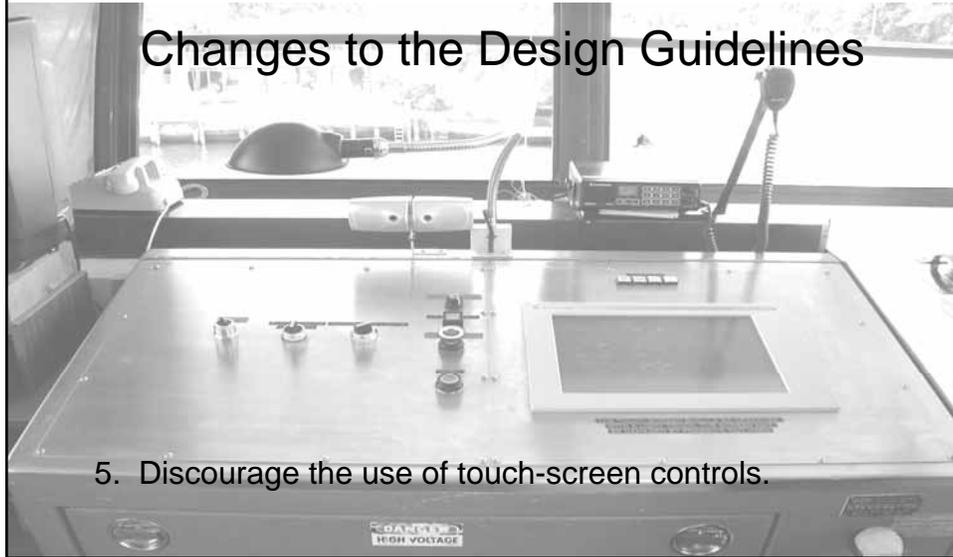
Added to 8.7.20 Functional Checkout Tests:

4.) Demonstrate that Traffic Lights turn RED when a gate arm is manually lowered.



# MOVABLE BRIDGES

## Changes to the Design Guidelines

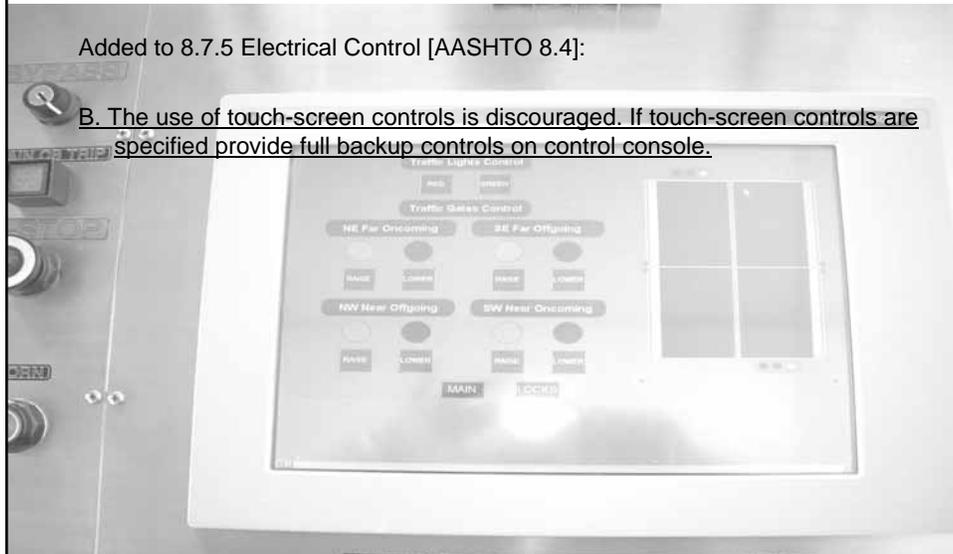


5. Discourage the use of touch-screen controls.

# MOVABLE BRIDGES

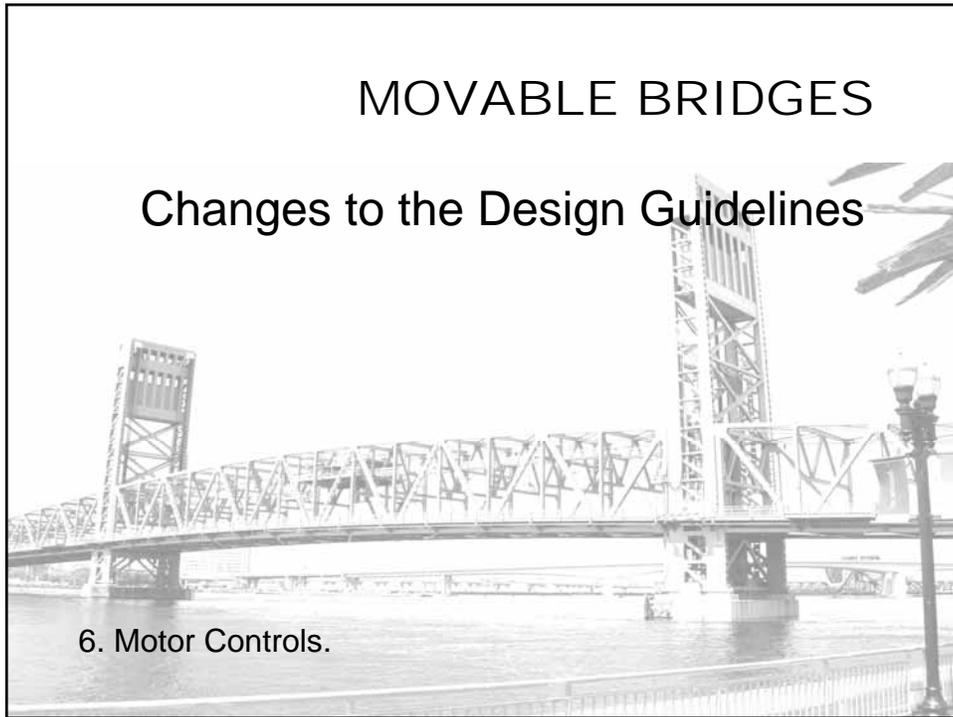
Added to 8.7.5 Electrical Control [AASHTO 8.4]:

B. The use of touch-screen controls is discouraged. If touch-screen controls are specified provide full backup controls on control console.



# MOVABLE BRIDGES

## Changes to the Design Guidelines



6. Motor Controls.

# MOVABLE BRIDGES

Added to 8.7.6 Motor Controls [AASHTO 8.6]:

B. Provide seal-in functions at starters only using auxiliary starter contacts, do not use separate relays or PLC outputs.



# MOVABLE BRIDGES

## Changes to the Design Guidelines

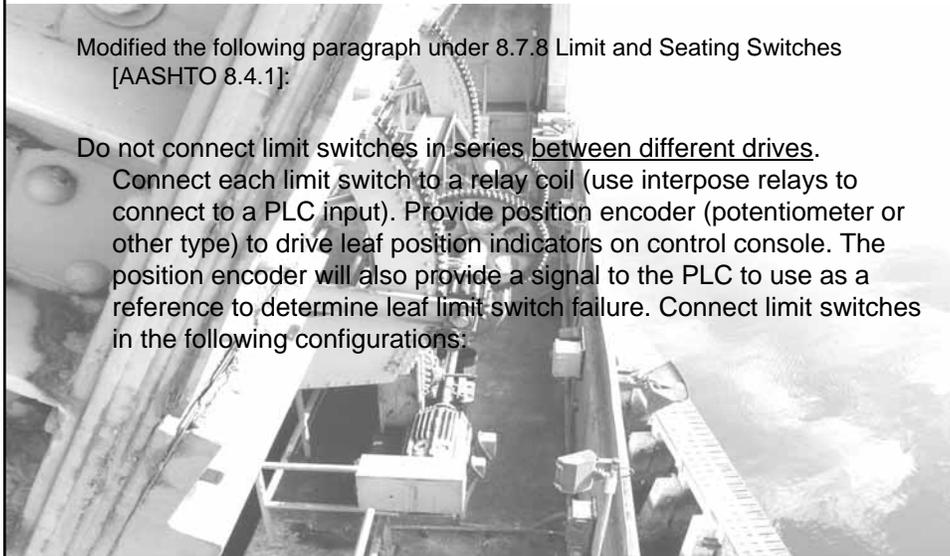


7. Limit Switches.

# MOVABLE BRIDGES

Modified the following paragraph under 8.7.8 Limit and Seating Switches [AASHTO 8.4.1]:

Do not connect limit switches in series between different drives. Connect each limit switch to a relay coil (use interpose relays to connect to a PLC input). Provide position encoder (potentiometer or other type) to drive leaf position indicators on control console. The position encoder will also provide a signal to the PLC to use as a reference to determine leaf limit switch failure. Connect limit switches in the following configurations:



# MOVABLE BRIDGES

## Changes to the Design Guidelines

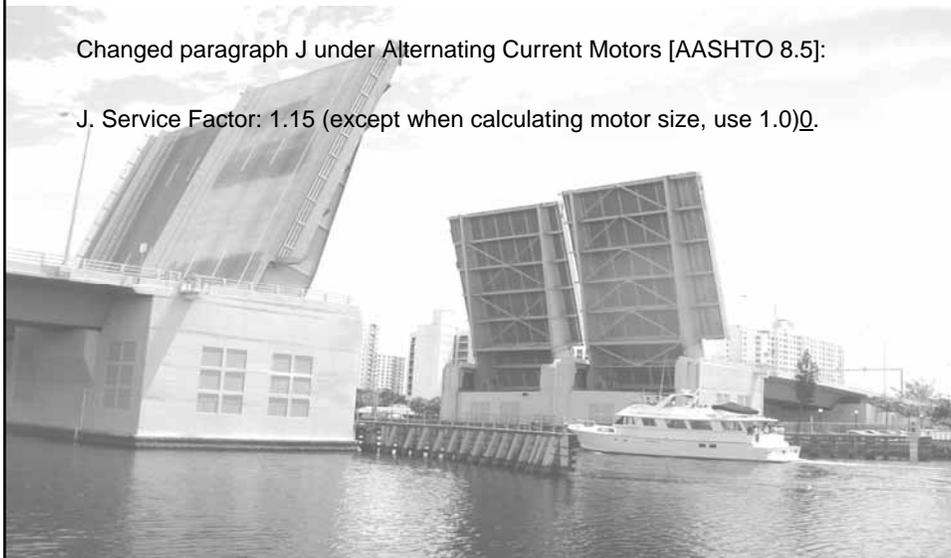


8. Motors.

# MOVABLE BRIDGES

Changed paragraph J under Alternating Current Motors [AASHTO 8.5]:

J. Service Factor: 1.15 (except when calculating motor size, use 1.0).



## MOVABLE BRIDGES

### Changes to the Design Guidelines



9. Navigation Lights Standard Drawing is now No. 1211.

## MOVABLE BRIDGES

- Other Items



## MOVABLE BRIDGES

Changes to 8.8 Control House Architectural Design:

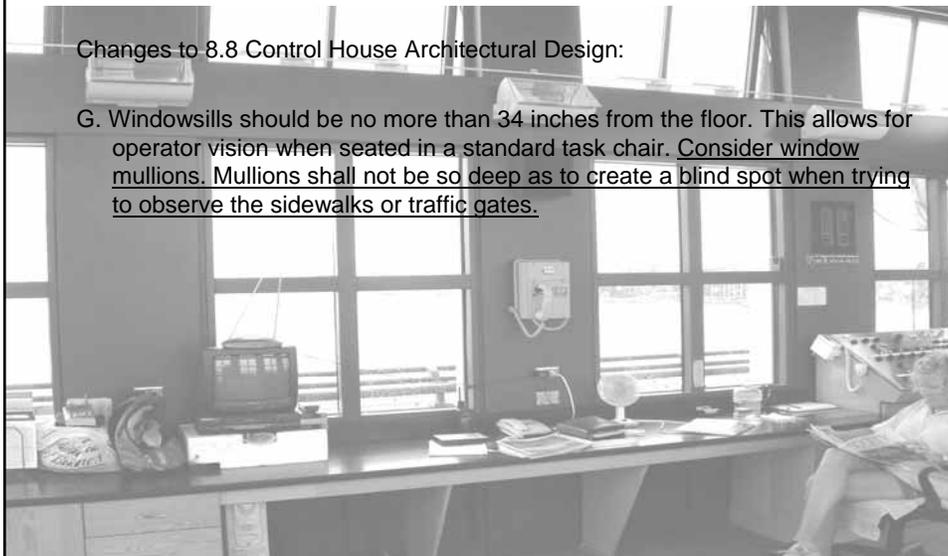
- F. Design the Bridge Tenders Room with a minimum of 200 250 square feet of usable floor space. This allows enough room for a toilet, kitchenette, and coat/mop closet as well as wall-hung desk and control console. Add additional square footage for stairwells, or place stairs on exterior of structure.



## MOVABLE BRIDGES

Changes to 8.8 Control House Architectural Design:

- G. Windowsills should be no more than 34 inches from the floor. This allows for operator vision when seated in a standard task chair. Consider window mullions. Mullions shall not be so deep as to create a blind spot when trying to observe the sidewalks or traffic gates.



## MOVABLE BRIDGES

Changes to 8.8 Control House Architectural Design:

- H. Consideration should be given to lines of sight from control station during column sizing and spacing. Column size and layout should not hinder lines of sight between control house and all traffic (vehicular, pedestrian and marine). The operator must be able to view all the above traffic from the control station.



## MOVABLE BRIDGES

Changes to 8.8 Control House Architectural Design:

- I. For operator standing at control console, verify sight lines to:
- 1.) Traffic gates for both directions of automobile traffic.
  - 2.) Marine traffic for both directions of the navigable channel.
  - 3.) Pedestrian traffic (sidewalks) and locations where pedestrians normally will stop.
  - 4.) Under side of bridge, at channel.



## MOVABLE BRIDGES

Changes to 8.8 Control House Architectural Design:

- K. Specify the control house exterior wall framing and surfaces to be bullet resistant; capable of meeting the standards of UL 752, Level 2, (357 magnum).

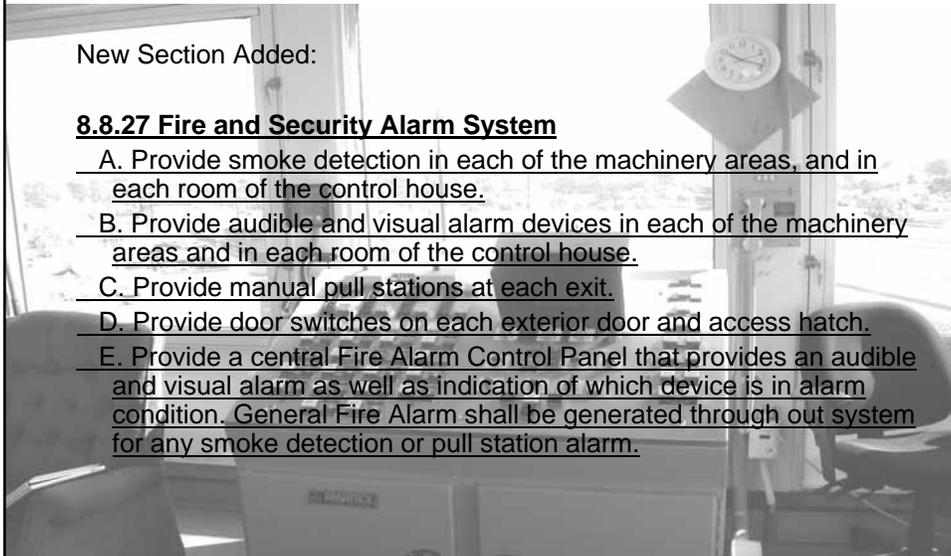


## MOVABLE BRIDGES

New Section Added:

### **8.8.27 Fire and Security Alarm System**

- A. Provide smoke detection in each of the machinery areas, and in each room of the control house.
- B. Provide audible and visual alarm devices in each of the machinery areas and in each room of the control house.
- C. Provide manual pull stations at each exit.
- D. Provide door switches on each exterior door and access hatch.
- E. Provide a central Fire Alarm Control Panel that provides an audible and visual alarm as well as indication of which device is in alarm condition. General Fire Alarm shall be generated through out system for any smoke detection or pull station alarm.



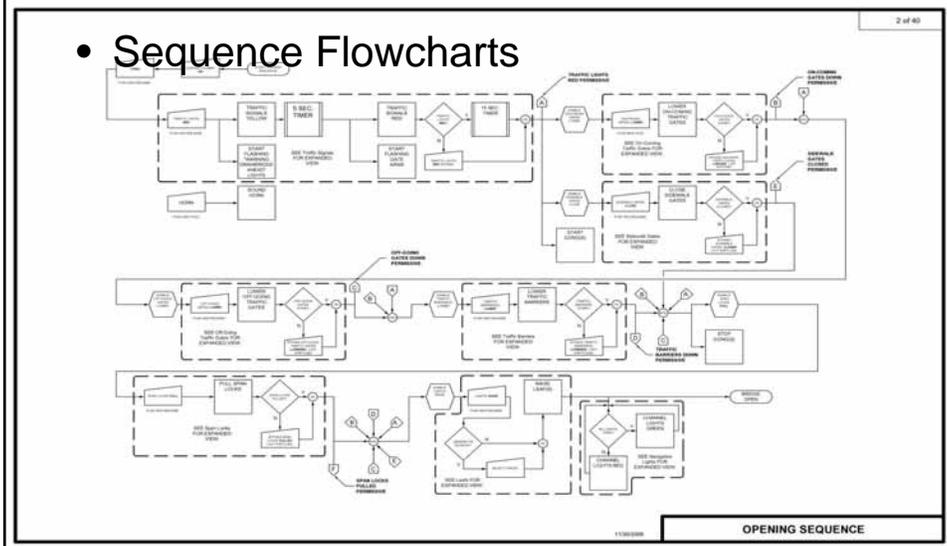
# MOVABLE BRIDGES

- Other Miscellaneous Changes



# MOVABLE BRIDGES

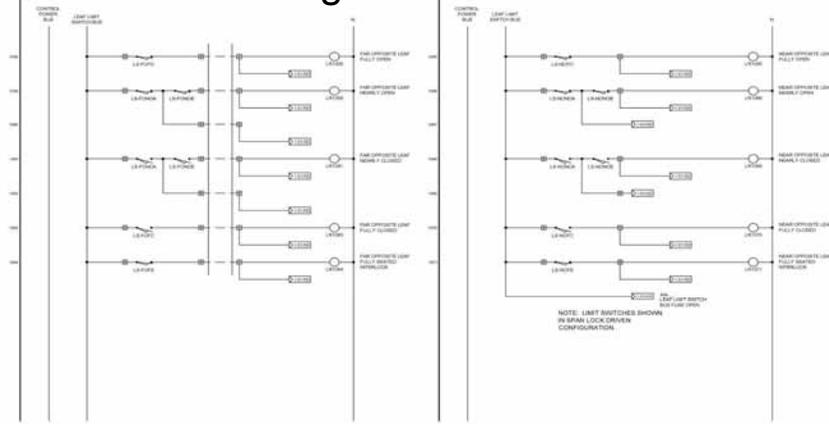
- Sequence Flowcharts





# MOVABLE BRIDGES

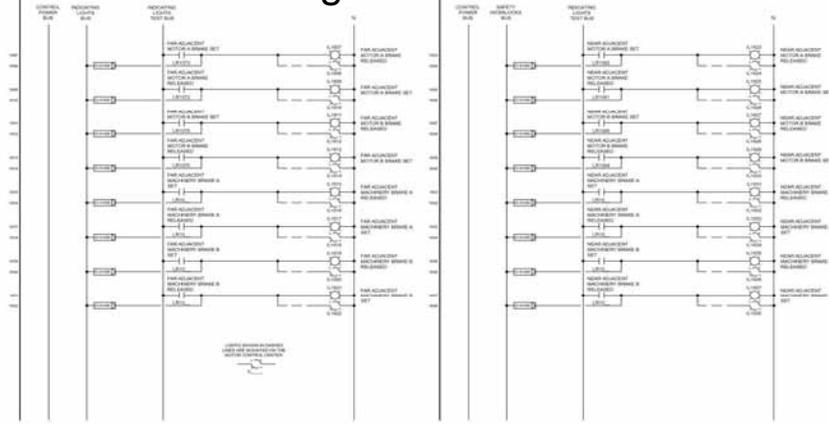
- Schematic Diagrams



LEAF LIMIT SWITCHES

# MOVABLE BRIDGES

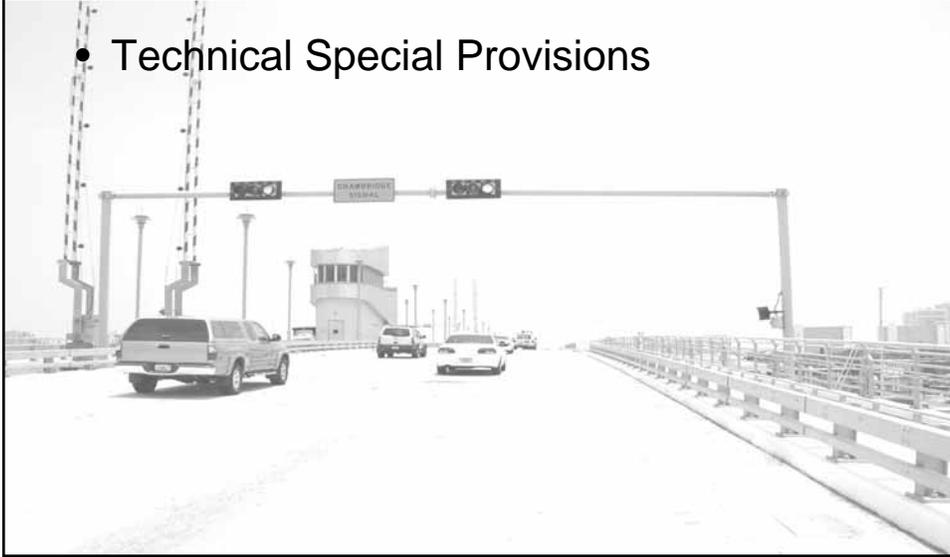
- Schematic Diagrams



INDICATING LIGHTS

## MOVABLE BRIDGES

- Technical Special Provisions



## MOVABLE BRIDGES

- "Or Equal"



## MOVABLE BRIDGES

- “Or Equal”

