Louisville District
U.S. Army Corps of Engineers
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DUCK CREEK
AUTOMATED GATE
CONSIDERATIONS
Design Issues and Problems

Associated with the Automated Flood Closure Gate
DESIGN CRITERIA

Engineering Manual EM 1110-2-2705
STRUCTURAL DESIGN OF CLOSURE STRUCTURES FOR LOCAL FLOOD PROTECTION PROJECTS
There are numerous types of closure structures or gates for openings in levees and floodwalls gates shown in the Engineering Manual.
DESIGN CRITERIA

1. STEEL SWING
DESIGN CRITERIA

1. STEEL SWING
2. MITER
DESIGN CRITERIA

1. STEEL SWING
2. MITER
3. TROLLEY
DESIGN CRITERIA

1. STEEL SWING
2. MITER
3. TROLLEY
4. ROLLING GATE
Design criteria

There are several different types of gates listed and information in the Engineering Manual that provides design guidance for the structural closures for openings in levees and floodwalls of inland local flood protection projects.
Duck Creek Automated Gate Closure
Using the Trolley Design (Note the Overhead Beam that is Required for This Type of Design)
Road Opening Where Automated Gate Closes Road
Automated Gate
with Trolley Attachments
Trolley Gate with Truck Shown in Road
Design criteria

1. Steel Swing
2. Miter
3. Trolley
4. Rolling Gate
FIRST SUGGESTED THE USE OF AN OVERHEAD GATE THAT WOULD BE POSITIONED OVER THE ROAD. THIS WOULD HAVE BEEN A BETTER DESIGN BUT THERE WAS A FEAR THAT THE GATE WOULD FALL AND POSSIBLE INJURY SOMEONE.
THE SECOND BRAINSTORMING IDEA WAS TO USE A TROLLEY TYPE DESIGN TO HELP ASSIST THE GATE ACROSS THE ROAD.

THIS IS WHAT WAS ORIGINALLY STARTED FOR THE DESIGN OF THE CLOSURE GATE.
Design criteria

THIS WAS A GOOD IDEA AND HAD BEEN USED BY THE HUNTSVILLE DISTRICT WITH WEST VIRGINIA AS YOU CAN SEE BY THE FOLLOWING PHOTOS.
Plan View of the Location for the Automated Gate
THIS TYPE OF DESIGN WOULD NOT WORK FOR THE FOLLOWING REASON:
1. THE GATE WAS APPROXIMATELY 70 FEET IN LENGTH AND WOULD SWAY TOO MUCH DUE TO WIND LOAD.
1. THE GATE WAS APPROXIMATELY 70 FEET IN LENGTH AND WOULD SWAY TO MUCH DUE TO WIND LOAD.

2. THE GATE WAS ONLY SUPPORTED BY THE TROLLEY AND SINCE IT WAS AUTOMATED THE GATE WOULD HAVE TO SEAT WITHOUT ANY MAINTENANCE PERSONNEL AT THE SITE.
THEREFORE WE THEN LOOKED AT ANOTHER OPTION SUCH AS THE ONE WE USE ON MITER GATES, WHICH IS A RACK AND PINION TYPE SYSTEM AS SHOWN IN THE FOLLOWING PHOTO.
THE RACK AND PINION SYSTEM WOULD HAVE REQUIRED SUCH PRECISION TYPE MACHINING AND PLACEMENT OF THE COMPONENTS THAT IT WAS DETERMINED NOT BE THE RIGHT TYPE OF DESIGN FOR THIS APPLICATION
I then proposed the following idea that led to the design of the closure system to be a winch type system which is typically used to move railroad cars.
THE PROBLEM WAS FINDING A CUSTOM TYPE WINCH TO BE USED TO PULL THE GATE ACROSS THE ROAD AND THEN BACK TO ITS ORIGINAL STORED POSITION
I consulted Russsel Witten in the Huntsville District about this type of winch design and he informed me of the following company Superior Lidgerwood Mundy of Superior Wisconsin.
I HAD A VERY SHORT DESIGN SCHEDULE AND WAS PROVIDED INFORMATION FROM KEVIN BERG AND DAVE BEATTY FROM SUPERIOR LIDGERWOOD MUNDY TO HELP ME WITH THE CADD DRAWINGS FOR THE WINCH TO MEET THE SCHEDULE.
WORKING CLOSELY WITH THE STRUCTURAL DESIGN ENGINEER, WE WERE ABLE TO COMPLETE THE DESIGN ON SCHEDULE. THE WINCH IS PLACED NEAR THE OPENING SO THAT IT USED TO PULL THE GATE ACROSS THE ROAD AND BACK TO STORAGE.
REVIEWERS OF THE DESIGN COULD NOT UNDERSTAND HOW THIS WOULD WORK, THEY COMMENTED THAT THE REQUIRED A PLAN AND SECTION AS INDICATED IN THE FOLLOWING SLIDE:
ENLARGEMENT OF GATE & WINCH

GATE HALF OPEN POSITION PLAN

SCALE: 3/16" = 1'-0"
TOP VIEW OF WINCH WITH A SINGLE DRUM

MOTOR GUARD

6 X 1-1/16" DIA. HOLES FOR 1" DIA. MOUNTING BOLTS
SIDE VIEW OF ELECTRIC WINCH

DRUM GUARD

DRUM GROOVED FOR 7/8" DIA. WIRE ROPE, 6x37, IRWC, XX|PS, BREAKING STRENGTH OF 87,600 LBS.

DIMENSIONS:
- 22" DRUM FACE
- 27" WIDE
- 16" TALL
- 31 1/2" DEEP
- 2 1/2" HOLE OF DRUM
- 45" BEHIND
- 47 1/2" FRONTo
- 2 1/2" BENEATH
Enlargement of Winch and Gate

US Army Corps of Engineers
Louisville District

MADISON RD FLOOD GATE
CABLE ANCHOR
WINCH
CABLE
WINCH PLATFORM
PIER "B" BEYOND
CABLE

GATE OPEN POSITION ELEVATION
SCALE: 3/16" = 1'-0"
ONE MAJOR CONCERN FROM THE LOCAL SPONSOR CINCINNATI MSD WAS THE FEAR THAT THE WINCH CABLE MIGHT FAIL AND INJURY SOMEONE
I informed them the winch and gate was well overdesigned. The normal industry practice for the cable on the winch would include a factor of safety of 3 for the cable against the operating load.
MY CABLE WAS DESIGNED TO A FACTOR OF SAFETY OF 5 AGAINST THE STARTING LOAD AND THAT THE WINCH WOULD OVERLOAD AT APPROXIMATELY 21,000 LBS. THE CABLE IS DESIGNED FOR A LOAD.
I PROPOSED THE FOLLOWING IDEA THAT LED TO THE DESIGN OF THE CLOSURE SYSTEM TO BE A WINCH TYPE SYSTEM WHICH IS TYPICALLY USED TO MOVE RAILROAD CARS.
Automated Closure
Gate with Winch Design
Automated Closure Gate, Note
Winch is Designed to Reel and
Unreel with One Drum

GATE OPEN POSITION ELEVATION
SCALE: 3/16" = 1'-0"
Gate in Half Open or Closed Position
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