ROLLER COMPACTED CONCRETE FOR McALPINE LOCK REPLACEMENT: BY DAVID E. KIEFER P.E.
PLAN OF THE
LOUISVILLE & PORTLAND CANAL
AND VICINITY

Scale: one foot to one inch.

NOTE: The red arrows show the direction and points from which the views were taken.
CONSTRUCTION OF 360’ 2-STAGE LOCK, 1870
CONSTRUCTION OF EXISTING 1200’ LOCK, 1960
McALPINE LOCK REPLACEMENT PROJECT

*360’ lock deactivated due to miter gate failure

*600’ lock used only as back-up (slow and unreliable)

*New 1200’ lock will add capacity and reliability

*New lock will be located south of existing 1200’ lock
NEW 1200' LOCK
Downstream Cell Construction
Upstream Cofferdam Cells
Demolition and Foundation Excavation
ENGINEERING AND DESIGN OF NEW LOCK

* Evaluate Alternative/Innovative Emptying and Filling Systems

* Evaluate Alternative Lock Wall Designs

* Perform Hydraulic Model Studies

* Select Best Alternative for Hydraulic and Wall Construction Considerations.
CONVENTIONAL INTAKE SYSTEM W/LOCK FLOOR CULVERTS
LOCK WALL OPTIONS

* Thin-wall design with tie-back anchors
* Reinforced Earth type wall
* Thin-wall design with deadmen
* Grouted Stone Fill
* Roller Compacted Concrete (RCC)

Selected as Preferred Option
ROLLER COMPACTED CONCRETE

* ACI 207; Concrete of no-slump consistency in its unhardened state that is transported, placed, and compacted using earth and rockfill construction equipment.

* A well graded aggregate mixture with a little bit of cement, fly ash and water thrown in for good measure.

* Looks like a pile of wet rock.

* Work it like dirt/soil, core it like concrete.
McALPINE LOCK CONSTRUCTION

* 150,000 cubic yards rock excavation

* 400,000 cubic yards concrete

* Access Bridge: 42 drilled shafts, 6’ diameter, 45’ to 100’ long

* 165,000 cubic yards backfill

* Traylor Bros, Granite, Massman (TGM)
CONCRETE MATERIALS FOR MASS AND RCC

* Crushed Limestone Coarse Aggregate, 2” NMSA

* Natural, River Dredged Fine Aggregate

* Class F Fly Ash

* Type II, max 80 cal/g cement
BATCH PLANT

- Twin 6-yard Besser compulsory mixers
- ASTM #3 (2-inch) and #57 (1-inch) coarse aggregate.
- Coarse aggregate wet belt and liquid nitrogen for temperature control.
- 70 Degree (Mass) and 80 Degree (RCC) temperature requirements.
WET-CHILL BELT
TEST SECTION

- Constructed to demonstrate suitability of Contractor’s equipment, methods and personnel.
- 50’ long by 30’ wide at top, (5) 1-foot lifts.
- Test section saw cut and inspected after placement for evaluation of RCC placement procedures.
TEST SECTION
TEST SECTION

6/24
6/23
6/22
RCC and conventional concrete transported from batch plant using Maxon Agitor trucks.

- Rotec creter-crane primarily used for concrete placement.
- Buckets and creter-crane used for RCC facing concrete
- Large and small rollers used for compaction
SOUTH LOCK WALL

EXISTING 600' LOCK WALL

2'-6" OF CONVENTIONAL FACING CONCRETE (TYPICAL)

CONVENTIONAL CONCRETE (TYPICAL)

BACKFILL

RCC IN 2'-0" Lifts (TYPICAL)

ROCK

EL.394.0

EL.425.0

EL.443.0

EL.370.0
RCC CONSTRUCTION
BEDDING MORTAR
CONSOLIDATION OF INTERFACE
CONSOLIDATION OF INTERFACE
QC – NUCLEAR DENSITY TESTING
INSERTING MONOLITH JOINT
SLOPING BACKFACE
LOCK WALL FACE
<table>
<thead>
<tr>
<th>Material</th>
<th>MASS</th>
<th>RCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>259</td>
<td>120</td>
</tr>
<tr>
<td>Fly Ash</td>
<td>187</td>
<td>156</td>
</tr>
<tr>
<td>Coarse Agg.</td>
<td>2350</td>
<td>2440</td>
</tr>
<tr>
<td>Fine Agg.</td>
<td>1070</td>
<td>1132</td>
</tr>
<tr>
<td>Water</td>
<td>187</td>
<td>174</td>
</tr>
</tbody>
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QUESTIONS ???