Design for Operations
Lessons from Rocks and Water

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Burnt Hills & Big Flats RR

Photos by author
Intro

• This is a refinement of a clinic given last year in Atlanta
• We will look at considerations for design of (or modifications to) a layout for operations
• Primarily will look at flow rather than individual components
• Some statistical and systems points
• How to increase the fun for your operations
Water Logic and Rock Logic

From Edward diBono

http://newmillenniumthinking.blogspot.com/2011/01/rock-logic-water-logic.html
Water Logic and Operations

• So often we pay attention to the rocks – layout design elements, track planning
  – Dr de Bono refers to a rock as having hard edges and a definite shape or form. The 'rock' represents absolutes.

• In layout design, we must consider the flow – the flow of our model cars (freight and/or passenger) and the flow of our human operators
  – “Water, will fill a pool, even in a mountain valley. The nature of this 'filling' is dependent on the topography, the terrain. “
Flow

• The real railroads generally don’t get paid for moving things or people aimlessly around and returning them to their starting point

• Exceptions
  – Tourist railroads / Fan Trips
  – The Union Pacific
U.P. Story

• Told to me by a U.P. engineer at the 2004 NMRA National (Seattle)
• Took a 120 car train from L.A. to Fresno, over the Tehachapi Loop
• Next day, picked up a train at Fresno to run to L.A., all but about 4 cars were the same as yesterday’s train
• WHY??????
U.P. Story

• L.A. yard was clogged
• There are $ bonuses for trains sent out
• 120 cars were grabbed, made into a train for Fresno
• Hope was that by the time the cars returned, the yard would be less clogged

• By the way, BNSF and UP unit trains are run over the hump to increase car counts – for bonuses
What is your terrain?

• Put your railroad on a map
  – Easy if you are modeling a prototype
  – Can be a little tougher with free-lancing

• Where does your flow come from and go to?
  Have connection(s) with the rest of the world
  – Piers / Car Ferries / Interchanges / Staging

• Don’t wander around aimlessly
  – How do your “Layout Design Elements” interact?
Put your railroad on the map
Tourist / Fan Trips can add interest

Still, needs to go from A to B (and return)
Flow Considerations

• The yards are like pools – how do we keep water flowing through them without backup?
• How much water are we trying to get down our stream? How much turbulence?
• How variable is our flow?
  – Note – variability does not “Scale” Our model length trains are relatively more variable than the prototype
True Point to Point?

- **Pros**
  - Was viewed as realistic goal in the 1950’s
- **Cons**
  - Usually insufficient mainline length
  - Shuttling back and forth between two endpoint yards
  - If no connections with outside world, hard to generate sufficient on line traffic
The Outside World

• Staging yards representing where your trains go when they leave the modeled area
• Interchanges with other railroads
  – Interchange yard, or even staging
• Ports, Car Ferries
Continuous Run Loops / Circles?

• Pros
  – Build up mileage between towns
  – Display running for visitors
  – Owner’s enjoyment in “running a train”

• Cons
  – Loss of feeling of going from A to B
  – Hard to schedule meets for trains running on repeated trackage (Train 1, meet Train 2, three times in Cadosia)
Point to Point and Continuous Run

- We can have the best of both worlds by hiding our continuous running loop so it is not used during operating sessions, but may be used for display running
  - Removable scenery
  - Block with cars
  - Use as interchange or industry
Hiding a Loop

What you see during an op session
Hiding a Loop

Versus just “running trains”
Hiding a Loop
Edison #3 Power Plant
Track to coal dumper

Dummy Track
Hiding a Continuous Run Option

“Normal Track” for point to point

“Loop Track”
Top of hill can be lifted like a flap (toupee?) to access the turnout.)
LOOP / NORMAL
(DON'T TOUCH!)
Note about Yards

• A classification yard is NOT:
  – A destination for cars
  – A place to store excess cars
  – A place to “cherry pick” cars out of to make up a train

• A classification yard is a temporary holding point to sort cars into trains to head to their final destinations

• Water logic, not rock logic
This was the classification yard on my original small layout. Now is an interchange yard on the expanded version.
End – to – End connection between the BH&BF (NYOW) and the Central of New Jersey
Variability

• Operations Researchers use the “Poisson Distribution” to describe the motion and counts of independent items

• Similar to single car movements on a railroad

• The standard deviation of a Poisson variable is the square root of the average (this is a measure of the variability)

• 95% of results will be within 2 standard deviations of the average
Variability – Prototype

• Let’s say a prototype train is 121 cars long on an average day. This means 95% of the time, the train will between $121 + 2 \times \sqrt{121}$ cars long and $121 - 2 \times \sqrt{121}$ cars long

• That is, 99 to 143 cars long, or

• Plus or minus 20%
Variability – Model

• Let’s say a model train is 16 cars long on an average operating session. This means 95% of the operating sessions, the train will between $16 + 2 \times \sqrt{16}$ cars long and $16 – 2 \times \sqrt{16}$ cars long

• That is, 8 to 24 cars long, or

• Plus or minus 50% (vs 20% for prototype)

• The modeler must account for much more variation in flow than the prototype
Variability – Implications

• Yards and other collection points for flow must be relatively larger to handle excess flow
• Or shift from single car movements with through blocks and even through trains
• Note this issue is even further exasperated by the (further than scale) compressed distances on the layout
Adding more sources of water (and places for it to go)

- Single car movements in modeled industrial sidings suffer from these variability issues
- Places for large blocks of cars to come and go are needed
- Large industries (receiving blocks of cars)
- Interchange yards
- Staging
- Car ferries/floats
End of the Line Blues

• A classification yard at the end of a dead-end branch or even mainline is questionable
• Why would a railroad haul traffic to the end of a line, only to turn it around and bring it back?
  – There are instances of “back haul” on the real railroads, but must be good economic reason
• Add staging beyond the yard or declare one or more tracks in yard as interchange (and run to edge of layout or backdrop or behind building)
Retrofitting Interchanges

• A yard at the end of a branch,
• An unused passenger terminal,
• A too small classification yard
• A stub track leading to the backdrop

Can easily be “repurposed” with some or all tracks designated as interchange with another railroad / railroads painlessly
“Staging”

• A way to send trains “off stage” to the outside world
• A way to have trains come in from “off stage”
• May be hidden or out in the open
• Trains may be used once, or multiple times during sessions
• A place to hold excess equipment
• May be “fiddled” during session, or not
Staging Options

Stub to Stub – little space req’d

Loop to Loop – good if equipment should stay on each end (mountain vs level, or two divisions).

Continuous loop good for open top loads/empties
Stub Ended Staging

Norwich – north end of BH&BF
5 tracks, each two train lengths long
1 x 6 board
Yes, I have to run loads back to the mines and return empties to staging between sessions.
Staging can be hidden
Stub End Staging

• Pros
  – Very little space required, especially as compared to end loops
  – Can be hidden or open
  – Easy to add to an existing layout

• Cons
  – Need to back trains in and out between sessions
  – How to turn locos (especially steam)?
  – How to handle open top cars (loads/empties)?
Stub End Staging +

Wye

Reverted Loop
To Fiddle or Not?

• Switching cars by hand in staging:
  • Pros
    – Can recycle equipment during operating session
    – No “start” or “end” needed to session
    – Less set up time for owner between sessions
    – More flow per track space
  • Cons
    – Someone has to man the “fiddle yard”
Prototype vs Freelance

• The prototype modeler has his/her “rocks” defined for them
• Water “flow” may be much more difficult for the prototype modeler than the freelancer
• There may be chokepoints on the prototype that required qualified and well-seasoned operators to deal with
• And there is the increase in variability issue
Prototype

• Don Barnes’ Baltimore and Ohio is a very literal model of the B&O “Old Mainline”
• Have set up operating sessions based upon historical freight procedure documents from the appropriate year modeled
• So far has been successful
• Some have complained it is “boring”
  – The prototype was not interested in “excitement”
Challenges for Switching Crews

• We compress our mainlines by factors of 5:1 to 50:1
• We operate with a “fast clock” to try to make up for the compression of space
• Switching time does not compress
  – We do have automated couplers (don’t have to connect air hoses)
  – But we can’t “kick” cars to minimize back and forth movements
Give the Yard Crews a Chance

- Make classification yard trackage as efficient as possible
- Have trains coming into yard pre-blocked
- Have some trains only drop/pickup blocks of cars rather than full termination
- Minimize “blocking” of outbound trains
Give the Locals a Chance

• I have found running the railroad like a modern hub airport has advantages – through trains are run into a yard during a time block, then send out several locals that won’t interfere with each other, then as locals return to the yard, do another time block of through trains.
Examples (Burnt Hills and Big Flats)

Flow – FROM anthracite mines and interchanges TO D&H interchange and Norwich Staging
Classification Yard is off center (1/5th)

Interchanges, mines, and heavy switching to south

Open running to north with some local switching
Norwich 5 track, two train length stub ended staging
Delaware and Hudson Interchange Yard in Sidney, plus two staging tracks for through trains
Delhi Branch
One staging track
Northwest Branch Mines
Erie Lackawanna
2 track Interchange Yard, plus three stub end staging tracks
New York
NORTH Pennsylvania
Burnt Hills
Norwich Yard
Sidney
Utica
Syracuse
Mayfield Yard
Mason
Big Flats
Scranton
Pleasant Mount
Northwest Branch
Oswego
Cadosia
Carbondale
Starlight

Central of New Jersey
3 track Interchange Yard
Capouse Branch to Lehigh Valley Coxton Yard
Two track, 2 train length long staging tracks
Maximize the length of flow

- Length expended on branches detracts
- Length expended on multiple routes detracts
- A midpoint division point shortens runs
- Put major traffic sources at ends of main / branches
- Maximize run between loads in / empties out
- Provide a consistent route from A to B
- Continuous run loops may be blocked off during operations but cleared for display running
Branches

• Can provide off the mainline opportunity for
  – New people to learn switching
  – Tougher switching puzzles
  – Different pace operations
  – Additional classification needs
Northwest Branch

Makes use of an otherwise unusable 42 inch by 10 foot long dormer bay
Adding Interchanges & Staging

- Interchanges and staging can be added to an existing layout / plan
- Interchanges and staging can receive ANY car type, and are efficient traffic generators
- Staging can be under existing layout or added as a shelf along wall or on top of bookcases
- Existing tracks with low utilization can be remade into interchanges or even staging
Next steps

• So, you have an identified route from A to B
• You’ve put A and B on the map
• You have connections
  – Staging
  – Interchange
• You have sufficient traffic sources to generate traffic

• What’s next?
Next steps

• Get Experience and Ideas from Others
  – NMRA Operations Special Interest Group
  – Attend Operating Sessions
    • OPSIG listing of operating railroads
    • Op sessions as part of conventions
    • Special Op Sessions (Dixie Rail, NC Rail Run)
    • Operating Groups (such as OFRRA in Aiken SC)
  – Read V&O Story, other books on operations
  – Consider John Armstrong’s Givens & Druthers checklist to formalize your own desires
Next steps

• Add car forwarding (traffic generation)
• Decide what trains need to service this traffic
• Decide how trains will be made up
  – You don’t necessarily need a modeled classification yard
• Determine sequence to run
• Get some folks together and have fun!
Consider Rocks and Flow