

YARD DESIGN - Tony Steele – 2/19/10 (fr. FORM 19, Orders 66-68, 1981-2)

What are Yards? They are investments (in 1981, each half-mile of track represented \$100,000 to \$250,000 in cost). They comprise the minimum physical plant that will accomplish the greatest utilization of labor, locomotives, cars, and tracks with the least disruption to traffic movements or operating costs. To realize these goals, a designer should thoroughly understand existing functions, required volumes of use, and possible growth impacts.

The following are sample duties of yards on a typical rail line:

1. Classification and Manipulation of Inbound cars for Local Industry Placement
2. Placement of cars on dedicated Terminal Tracks for Loading/Unloading
3. Storage of cars or locomotives until needed
4. Classification of Inbound cars for proper Outbound Forwarding
5. Protection of Inbound Pre-Blocked cars for proper Outbound Forwarding
6. Classification of Inbound cars for Local Interchange Placement
7. Performance of Car Service or Running Repair functions
8. Performance of Locomotive Service or Running Repair functions
9. Performance of special Service functions (TOFC, Stock Watering, Weighing, Icing, Car-Cleaning, etc.)

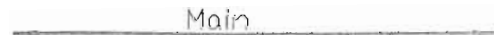
Some major Yards and Terminals are designed for all of these - and much more!

In the Prototype, what Pitfalls do we seek to avoid?

1. **Conflicts**: Between road trains and yard engines, train movements and shop movements, maintenance work and normal operations, rail traffic and road traffic, etc.
2. **Rehandles**: Extraneous time, fuel, and equipment used to place cars in the ready-to-depart status.
3. **Dwell Time**: the unproductive time spent in yards, incurring additional costs - “foreign” per diem, horsepower-hour charges, or larger “home” fleet size - as well as additional tracks for the effective purpose of storage.
4. **Work Areas Away from Supervision**: Yardmasters, Trainmasters, Mechanical Foremen, etc. should not be separated from the areas of regular work.
5. **Spread-out Work Areas**: Work done by the same Crew or Gang should not require excessive travel time or lost motion.
6. **Work that Breaks Up Train or Block Integrity**: Avoidable servicing procedures – causing waste effort and delays – may be “streamlined” with road-access to tracks (in-train car servicing and repairs), in-motion scales, mainline refueling locations, or the arrangement of other special facilities parallel to the yard.
7. **Workflow Spread Apart**: As cars and locomotives progress, movements should be optimized. Pickups and setouts should be adjacent to the classification leads, as should Car Repair and special servicing facilities. Serviced cars and power should easily feed back to those leads.

8. **Bottlenecks:** No important function should be unique to one track when delays can multiply. Approaches to the yard from the main line may have to be duplicated. Classification leads should be flexible (switchable from neighboring tracks).
9. **Maintenance of Way Difficulties:** Access to turnouts and crucial tracks should not be by foot alone. Adequate room for snow clearing and regular maintenance vehicles is necessary.
10. **Inadequate Future Expansion Room:** Space used for today's activities should not be contiguous. Some room for each area (classification, servicing, offices, etc.) should be reserved next to the existing one, for growth.

Let's design a yard and analyze it, step by step.



Through Track

Already existing is a Through Track (a Main Track, Industrial Lead, Running Track, etc.) For most yards, this remains as a passenger and freight Bypass for those trains conducting no business in the yard. (In some large central yards without passenger service on the main, no bypass track may be required, if all trains will get crew changing, car or loco servicing, or block exchanging.) The Bypass should be located to one extreme side of a yard in order to avoid "crossover" yard moves, from one side to the other. (Quite often, a small station will be located on this line, opposite the yard.)

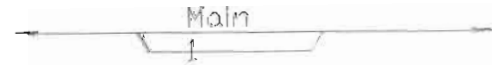
Road Switch

The first addition is a turnout and track to store cars between trains (or to serve a customer). The Main is occupied during all work, but since only block exchange and some car shuffling are possible, no great operating difficulty is introduced.



Run-Around Track

The next improvement is a second turnout so that maneuvers can be performed by trains headed in both directions. A run-around function is also now possible.



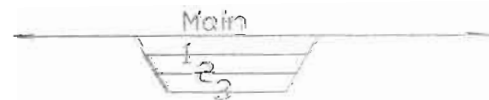
Local Terminal

Two more single-ended tracks are added beside the first one. These may be dedicated Terminal Tracks (for an industrial district, large plant, or specific facility). Now all sorts of classification can be done by a Local Train to put its consist into Station Order, or by a through train to adjust its pickups and setouts. Yards like these also serve to store cars until local or system use requires their retrieval.

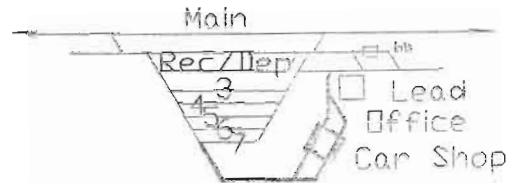


Local Yard

Double-ending the tracks allows not only directional flexibility and the reduction of double-handling of cars, but also work or arrival-departure from both ends simultaneously.

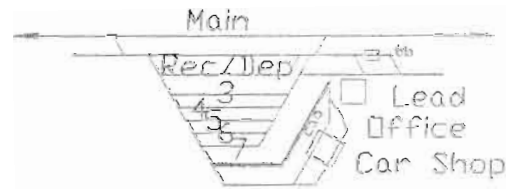


Traditionally, balance-beam scales were sited adjacent to the yard or the primary lead; once a shift, a string of “weighs” was taken from a Class track and spotted individually, one after another, to be ticketed. The more recent in-motion scale (using pressure-cells or rail-mounted strain-gauges, for coupled cars, weighing each axle) allowed placement in the Main for unit trains, at a lead into the yard, or on the primary Lead, avoiding much of the aforementioned repetitive actions. However, the precision of in-motion technology was not widely accepted, initially, for official shipment weights for individual cars.



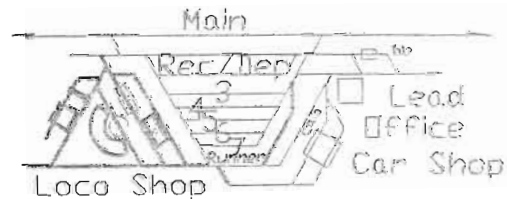
Car Shop

Car Repair functions should be handy to the primary Lead in order to directly transfer Shop cars in and out of the facility without storing them in the yard for extended periods. It needs to be closed to switching activity (“Blue Flagged”) while inspection and repair forces are at work. Facility designs vary widely from minor running repairs on a stub track to complex repair shops with mechanical movers to shift the cars to repair points.



Caboose Servicing

Caboosees should be serviced (fuel, clean, resupply, etc.) at their assigned terminals. This should be at a location handy to both leads and the car forces that perform this work. This could be the outermost track in the yard, or one directly adjacent to the Car Shop.



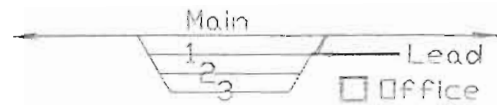
Locomotive Servicing

The Locomotive Servicing facility can be almost anywhere as long as:

1. Inbound and Outbound Power consists can proceed directly between the facility and their trains without fouling the primary Lead or Main. (Note, however, the new Runner track to expedite those times when the primary Lead must be crossed!)
2. Duplicate access is available to as many tracks as possible to avoid unnecessarily idled power due to facility congestion or accidents.
3. Turning capability of units and consists is available for their quick turnaround.

(So far, there is no design avoiding road/yard conflicts; the main is shared for all work.) The strategic capabilities of this yard site are tempting us to station a local crew here. This will occur if the expenses of existing switching, travel time to and from the nearest yard, yard congestion here and elsewhere, and road train switching time are becoming objectionable – and if the new costs (tracks, agreements, offices and personnel welfare facilities, and locomotive idle time) are not greater expenses.

Yard Job



For the cost of a track and turnout (and reworking two existing ones), a high degree of switcher utilization can be achieved by installing a Switch Lead. Only half of the theoretical road-to-yard movements will interrupt classification work. Judicious planning of actual use will allow the Lead to be placed at the low-density (of road activity) end of the yard and to schedule local service (elsewhere) when the Lead end is to be worked from the Main. A yard building – for offices and crew quarters – is placed near the lead, in supervisory view of switching activities, for safety and efficiency purposes.



Twin Leads

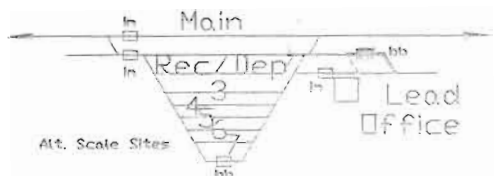
The addition of another Lead allows full segregation of road and yard actions. It also enables any second set of power (road or yard) to work at that end without fouling the main. A block of cars can be assembled twice as fast, using two Leads.

Up until now, we have developed a small yard with a dedicated switch crew, primarily serving local Industry and Terminal needs. Let's add some system-wide blocking responsibility and more road-to-yard movements. More tracks and dedicated Receiving/Departure tracks become warranted.



Receiving/Departure Tracks

Besides the additional Classification tracks, provision for the separation of two R/D tracks from both the Main and the primary switching Lead is included. This allows simultaneous, non-conflicting movements on all three, while enabling steady train construction on the R/D tracks when they are available for such. Standard practice (in 1981) preferred 18' to 26' track centers to allow for in-train inspection, servicing, and repairs to be performed from specialized vehicles.



Track Scales

Unless Standard Weight Agreements (nominal weights) are in effect with shippers and connecting lines, scales can become necessary to (at the very least) spot-weigh cars.

Ten tips for freight yard design and operation

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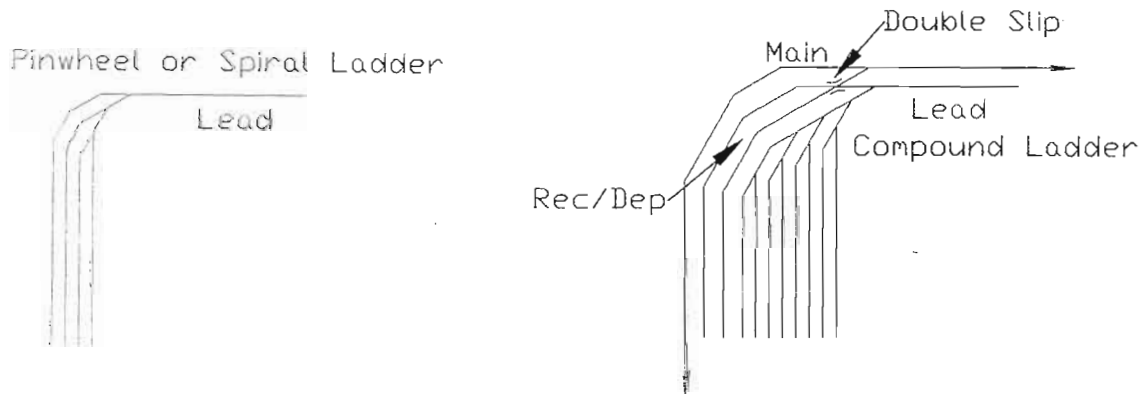
1. **Cars don't belong in the yard.** Cars can't be loaded or unloaded in a yard (intermodal yards being the main exceptions), and cars standing in a yard aren't generating transportation. The purpose of a yard is to organize cars into trains, interchange transfers, or switching cuts so they can be taken somewhere else for loading and unloading.
2. **When space is tight, use something other than a straight ladder.** Compound ladders, pinwheel ladders, and ladders on the angle of the next smaller frog will allow longer body tracks in a given length.
3. **Include a drill track as long as the longest body track.** Allowing a switcher to drag out an entire track for sorting generally expedites classification switching.
4. **Allow trains to arrive and depart without interfering with yard switchers.** When switch engines don't have to stop work to let road trains in or out, more can be accomplished in a given time and operators won't have their plans interrupted.
5. **Use staging tracks to provide off-layout destinations for trains and cars.** Let staging be the "somewhere else" where cars in a yard are supposed to go, over and above the industries on your layout. Staging can represent anyplace not represented on your layout: a distant terminal, a connection with another railroad, or an industrial district (or large industry) just out of sight.
6. **Operate with paperwork that deals with cars in the order they stand on the track.** Whether you choose hand-written switch lists, car cards with waybills, or computer-generated lists, you'll save time and confusion if you can handle cars in sequence as they come in trains, blocks, and switching cuts.
7. **Sort arriving cars by where they go next.** Cars classified as they arrive into outbound blocks and trains require less handling in the yard between arrival and departure.
8. **Prefer to model a yard located at or near a junction.** Consolidating traffic from and separating traffic for different lines adds interest to the switching even if most trains just pass through the yard. And the junction can be merely "notional" or "conceptual," off the modeled layout in staging.
9. **Assign multiple operators to help the yard keep up.** A common complaint is that trains cross our too-short main lines so quickly that the yard inevitably falls behind. But it does it make sense to expect one yardmaster to keep ahead of six or eight road engineers? Additional yard operators can run a second yard engine, hostile engines at the roundhouse, switch local industries and interchanges, or any combination of these tasks.
10. **Double-endedness is a good thing.** The more through tracks a yard has the more flexible it will be for handling trains in both directions. And since the real railroads overwhelmingly prefer through yards, a double-ended model yard will look more realistic.

IDEAS ON MODEL RAILROAD YARDS

A Modeler should know his or her limitations. Space availability (for the Layout) may curb ambitions of empire, but it also sharpens the sense of editing, abbreviation, and compression in the Yard Designer. What length of track capacity, how many tracks, how many connections to the serving "Through" track; these are important questions.

Track Lengths – the longest block of cars to be received at or forwarded from the Yard should fit on the longest track, with two straight carlengths centered on the block's ends, near each Ladder Track [for most effective coupling and uncoupling]. The rest of the track may be curvaceous as heck. The Lead should be at least this long, too.

Space-Saving Ladders and Turnouts – Note the waste space required for crossovers and any other geometry that employs reversed curves. Consider the advantages of Pinwheel (or Spiral) Ladders for elimination of those reverses for Yards of just a few tracks and Compound Ladders for a larger number of tracks. Another benefit: the Turnouts used in these can be smaller/shorter (lower Frog Number) than otherwise, for a given track centering. While usually found in Passenger Terminal Throats, a Double-Slip Turnout can be a very handy way to connect the Main and the Lead with the Receiving/Departure tracks. {While track spacing can be tightened to prototype, remember finger access.}



Classification Track Assignments – the simplest system is the "Static", or fixed, with all cars for a given block/destination being classed to the same track (or portion of it) every time. But since some trains are not daily – and some might be several per day – some time sharing of class track space ("Dynamic") may be possible, with a few other tracks relegated as general "For Now" storage (until those cars' blocks become necessary for train construction). The ultimate in this regard would seem to be the two-stage Re-Classing (my term: Matrix Switching), wherein if there are "N" tracks, (up to) "N²" blocks may be made, with careful forethought. Note: the Lead must have a length equal to the sum of all tracks!

