

# **Lightweight Sectional Construction for Model Railways**

**Calgary Model Railway Society Clinic**

**20 Oct 2019**

**Ironside**

***Sectional***



***Fixed***



***What is your favourite layout  
working position?***

**Learn by Doing**

***Then do it again***

*(or learn by someone  
else doing)*

# **Lightweight Sectional Construction for Model Railways**

**Calgary Model Railway Society Clinic**

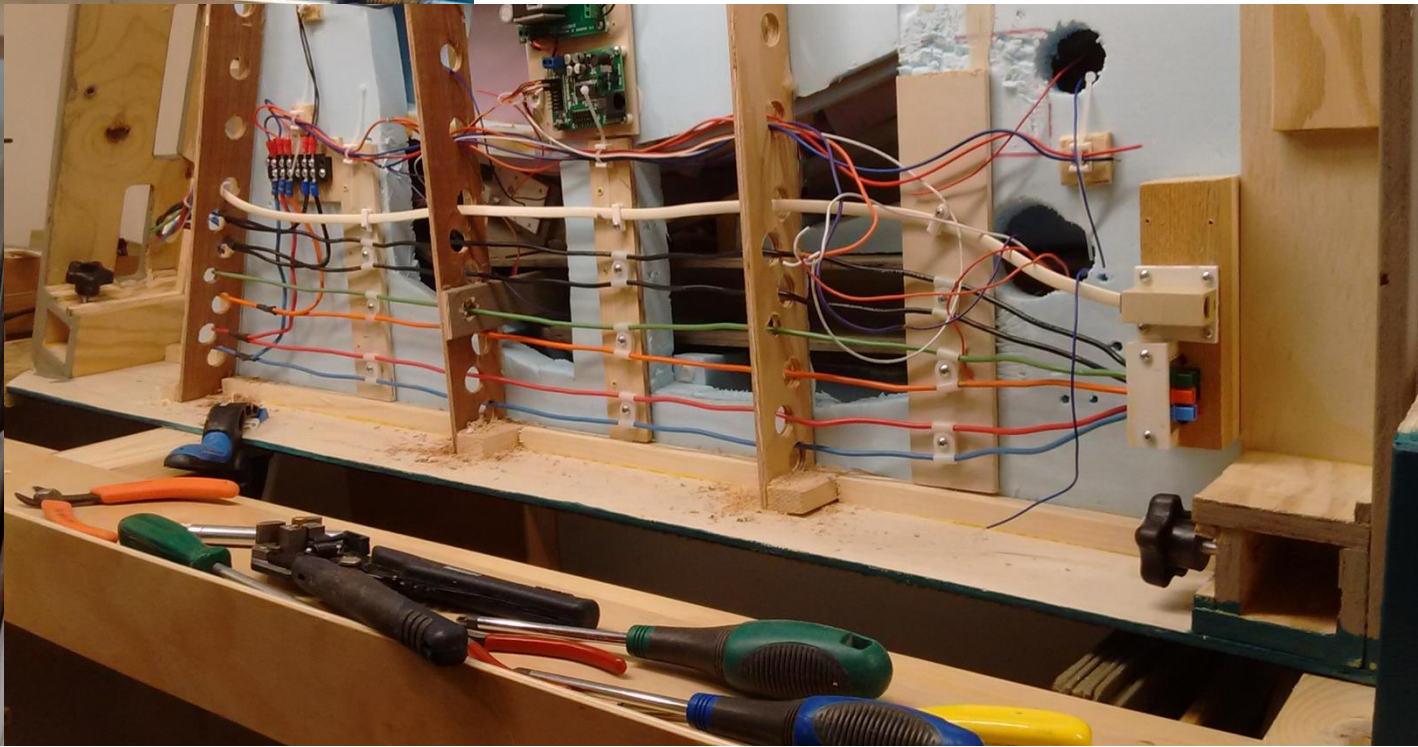
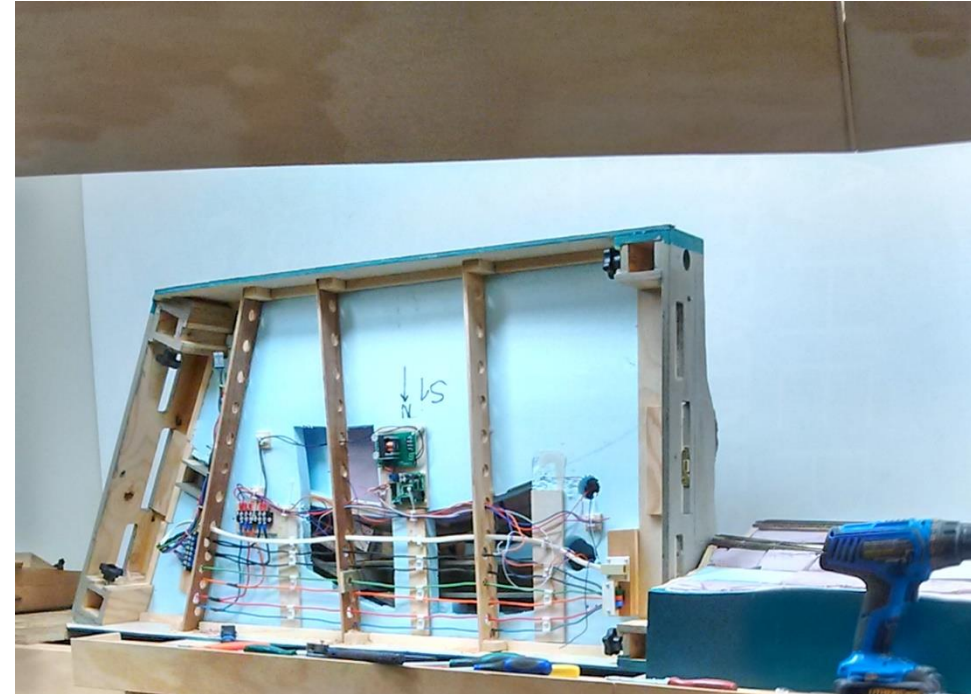
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# Why Sectional?

- Life is a bitch
  - Moving can befall us all – destruction is often alternative to sectional
  - Soldering wires lying on your back under a layout is not fun. Better with a section of layout on edge on workbench
  - Troubleshooting is much easier on a section at a time, rather than on 100' of layout
  - Easier to motivate progress a section at a time
- But it is only a Section if you can move it!!!

**This is for real  
- wiring one of  
my sections**

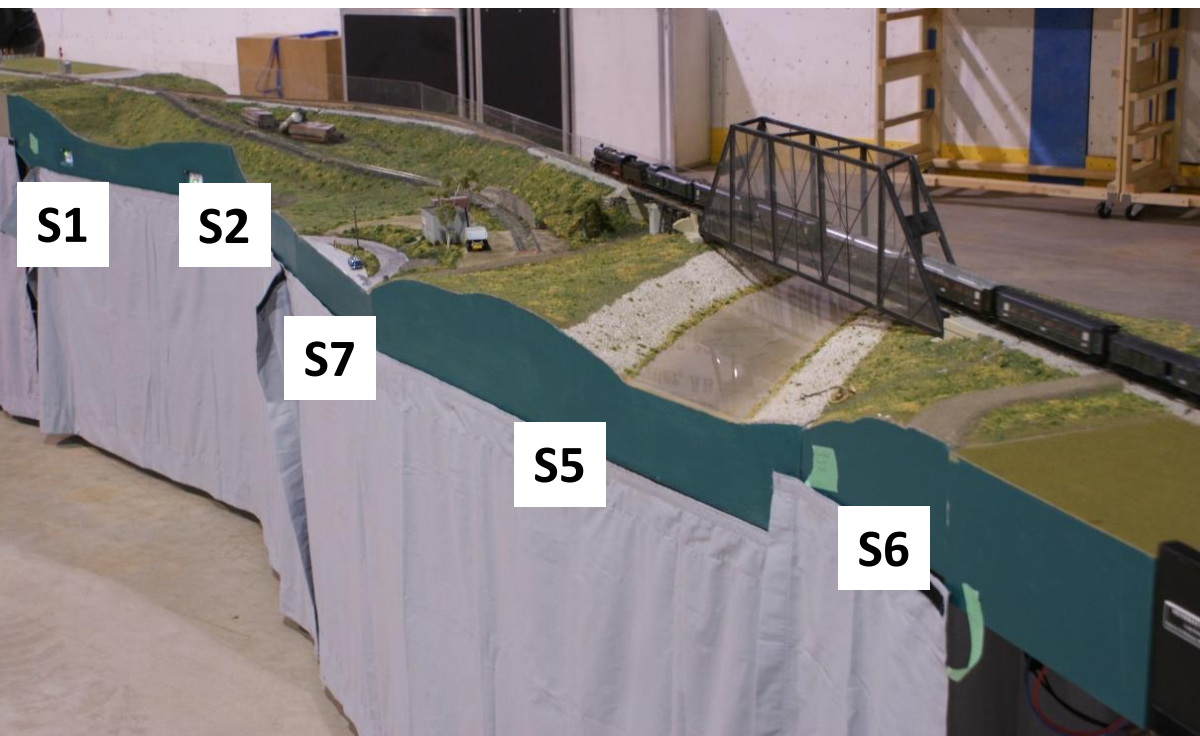
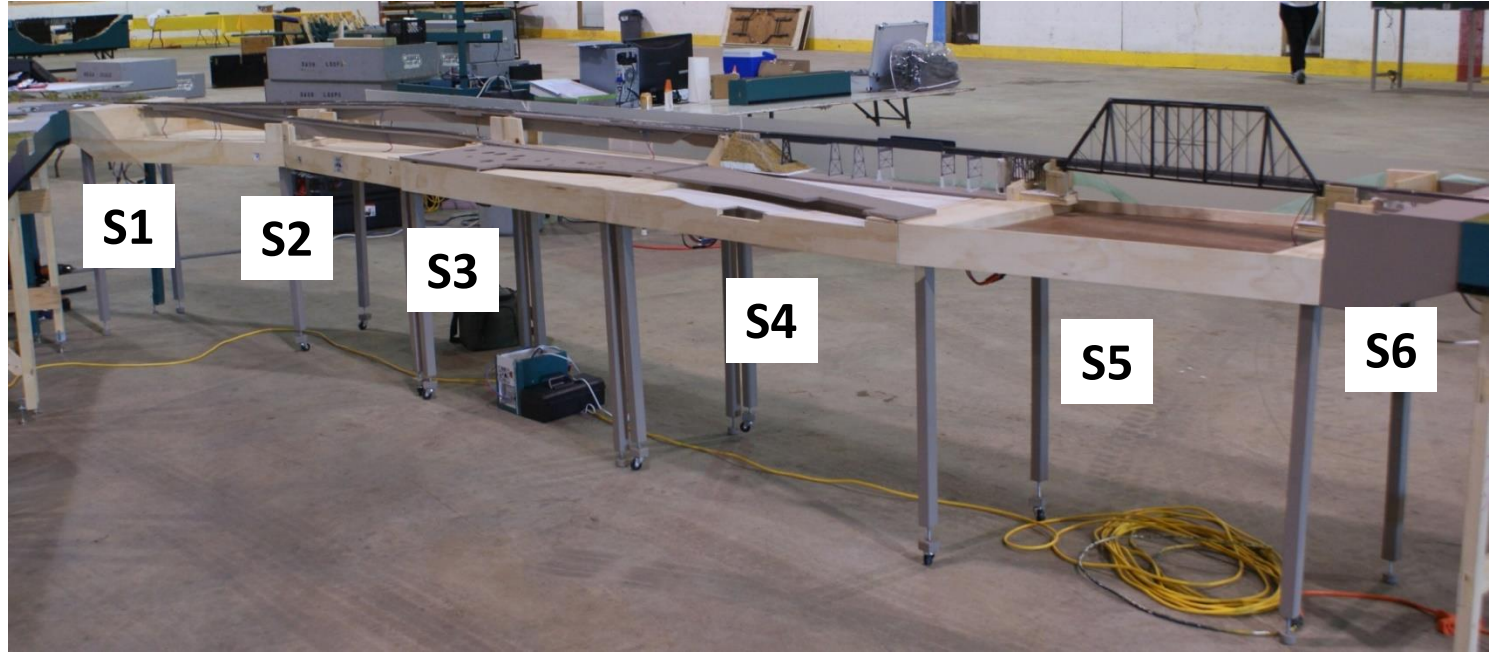


# Fundamental Requirements

- Size:
  - Able to get it through (perhaps unknown) access routes with corners
  - Normally about 4'-6' long for a 2' wide section, shorter if wider
- Weight
  - Reliable help for moving it? If not, limit is what you can move by yourself
  - Ideally under 15-20kg
- Protection when moving/ working
  - If you move it regularly, include a coffin in the calculations
  - Moving usually requires tipping section on side or end
  - Nothing should protrude when sitting on side
- Removeable bits
  - If some structures or features are very large, or are fragile, or cannot be tipped, plan for them to be removeable
- Reconfiguration
  - If there are variable arrangements of the pieces, standardize interfaces
- Reassembly
  - If it will be re-assembled frequently, consider alignment devices

**PLAN AHEAD**

# Ogden Road Example



Full 21' Config, 6 sections  
(Rebuilt unfinished version)  
8' Timesaver

Small 15' Config, 5 sections  
(original version)  
2' substitute for 8' Timesaver

# Build Philosophy (1)

## PLAN AHEAD

- For strength, use structure, not mass
  - Beams of  $\frac{1}{4}$ " ply, not simple  $\frac{3}{4}$ " ply sheets
  - Reinforced gluing areas
  - Lightweight materials such as foam where minor instability (eg shrinking, warping) can be tolerated
  - More rigid material such as ply where stability important, eg under track
  - Holes to remove material not contributing strength
- Too rigid is a disadvantage
  - A little compliance goes a long way

# Build Philosophy (2)

## PLAN AHEAD

- Use glue, not fasteners
  - Metal fasteners only where disassembly is required or at critical high-stress locations
- Make and assemble in most efficient order
  - If multiple copies, make all at once
  - If access restricted after assembly, do sub-assembly or finishing first
  - Use fixtures/ jigs to ensure sizes, angles, alignments
  - Where alignment between adjacent sections required, join them to do alignment steps

# Overall Build Process

## PLAN AHEAD

1. Make interfacing end plates in matching pairs
2. Make end assemblies
3. Add sides
4. Add reinforcing glue strips and braces
5. Add top
6. Add roadbed/ track across joined sections/ cut at joint
7. Add electrical
8. Add scenery

**Done**

# Build Process (1)

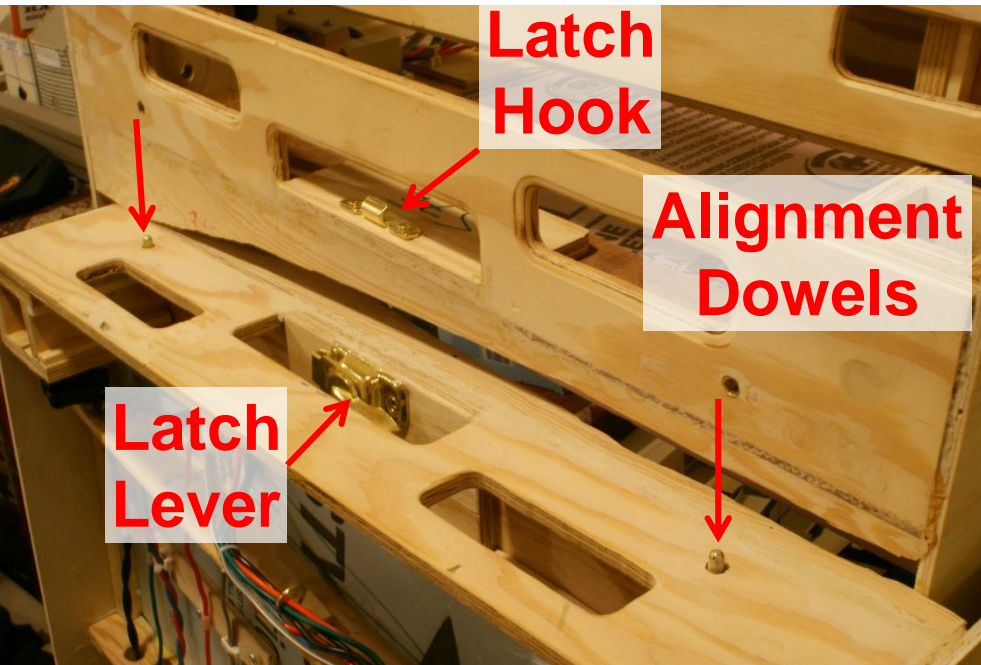
- Make interfacing end plates in matching pairs
  - End plates of  $\frac{1}{2}$ " ply for strength with some compliance
  - NOT  $\frac{3}{4}$  Ply which provides too much rigidity
- Make end assemblies
  - Top first few inches form stable base for inter-section track, and reference for rest of section
  - Leg pockets if required
  - Angled for sides if required
  - End profiles cut with corresponding ends attached. Profiling also possible after full section assembly

# End Assemblies

## Ends critical to ensuring that sections can be re-assembled

- Ends built first in matching pairs - mark pairs!
  - End Plates
    - Cut and route end plates for handholds etc
    - Drill end plate pairs together for interconnection means eg latches or bolts if used
    - Drill end plate pairs together for alignment means eg dowels or shelves if used
  - Assembly
    - Add end top to end plate
    - Add leg pockets to end plate and top if used, else side plates
    - Use jigs/ fixtures to ensure correct angles and fits
  - Install alignment means if used
  - Install inter-section securing means if used

# Dowels/ Cam Latch Joining Sections



**1/4" Ply top**

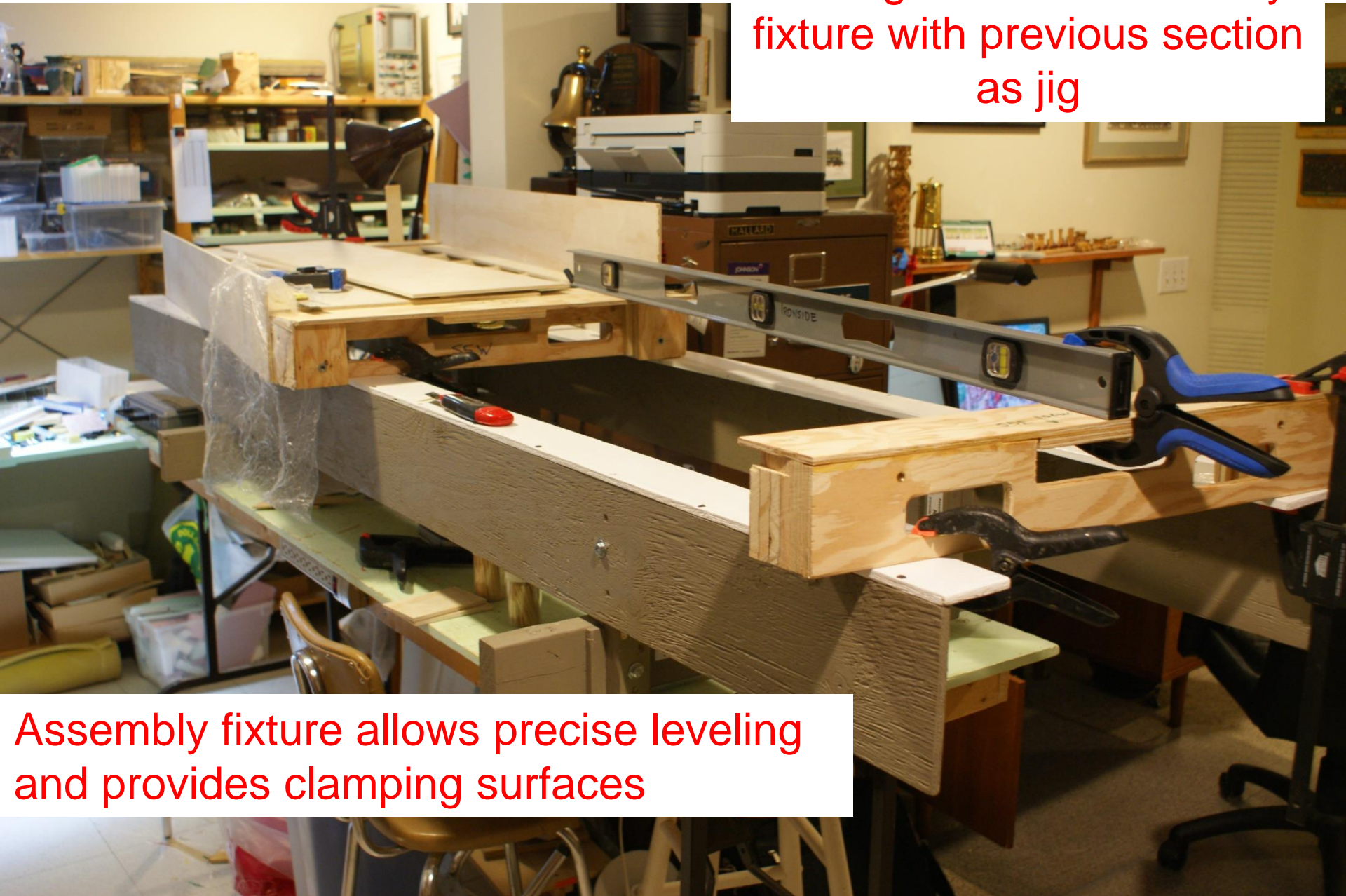
**Reinforcing plate under Latch**



# Build Process (2)

- Add Sides
  - Use assembly fixture or good flat surface to ensure alignment
  - Sides have straight bottom edge (gives reference edge for assembly fixture), top edge to match scenery profile
    - profile can also be cut during scenicking
- Add bits inside
  - Cross beam structure strengthens top
  - Gluing strips for attaching top
  - Cross beams have holes to run wiring
- Add top
  - Foam or ply, depending on situation

Adding sides on assembly  
fixture with previous section  
as jig

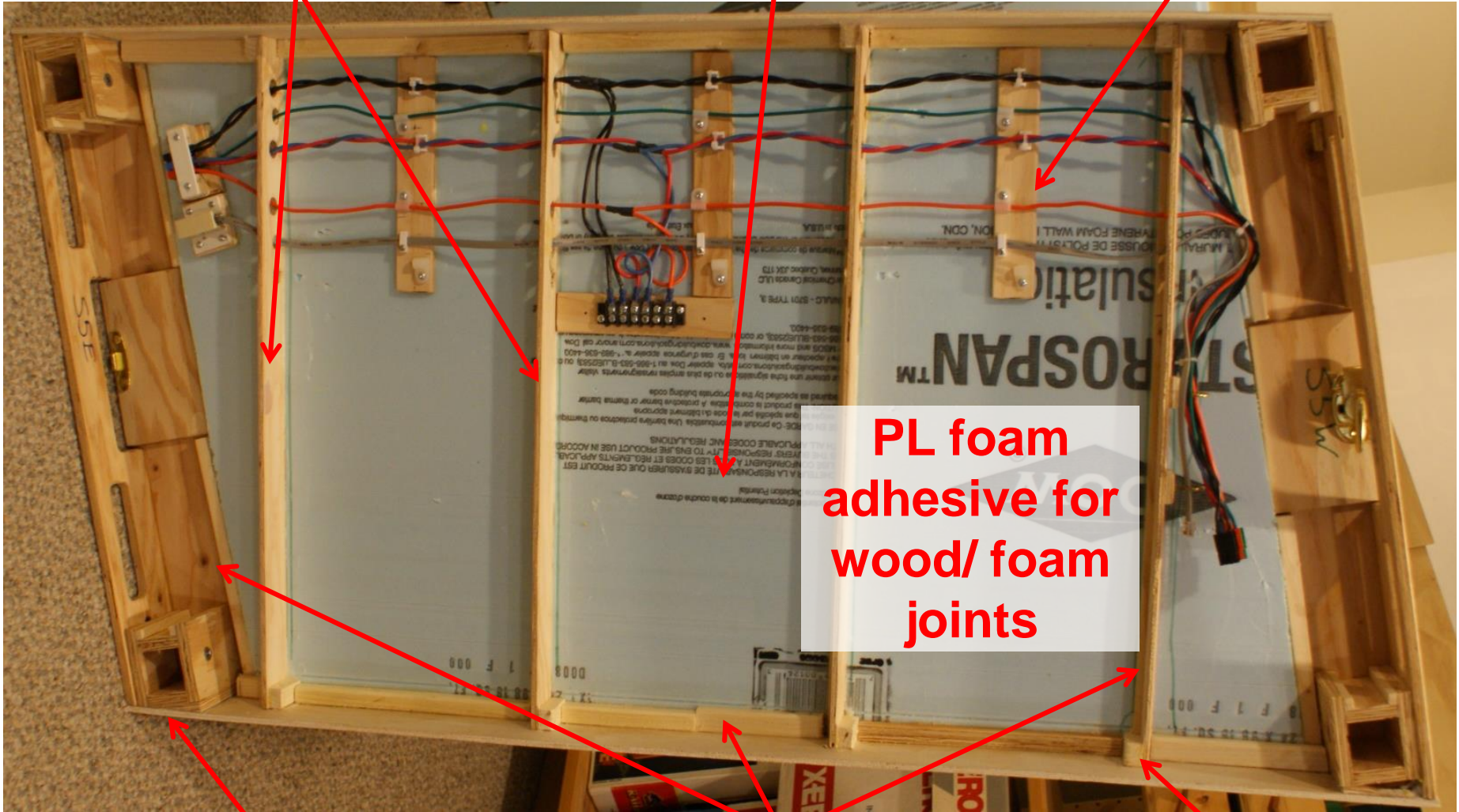


Assembly fixture allows precise leveling  
and provides clamping surfaces

**Cross beams with holes  
for wire routing**

**1" Foam  
top**

**Wood plates for  
clip hardware**



**PL foam  
adhesive for  
wood/ foam  
joints**

**Angle end assembly  
for skewed section**

**Glue strips for top  
adhesive**

**Glue joint  
reinforcement**

# Build Process (3)

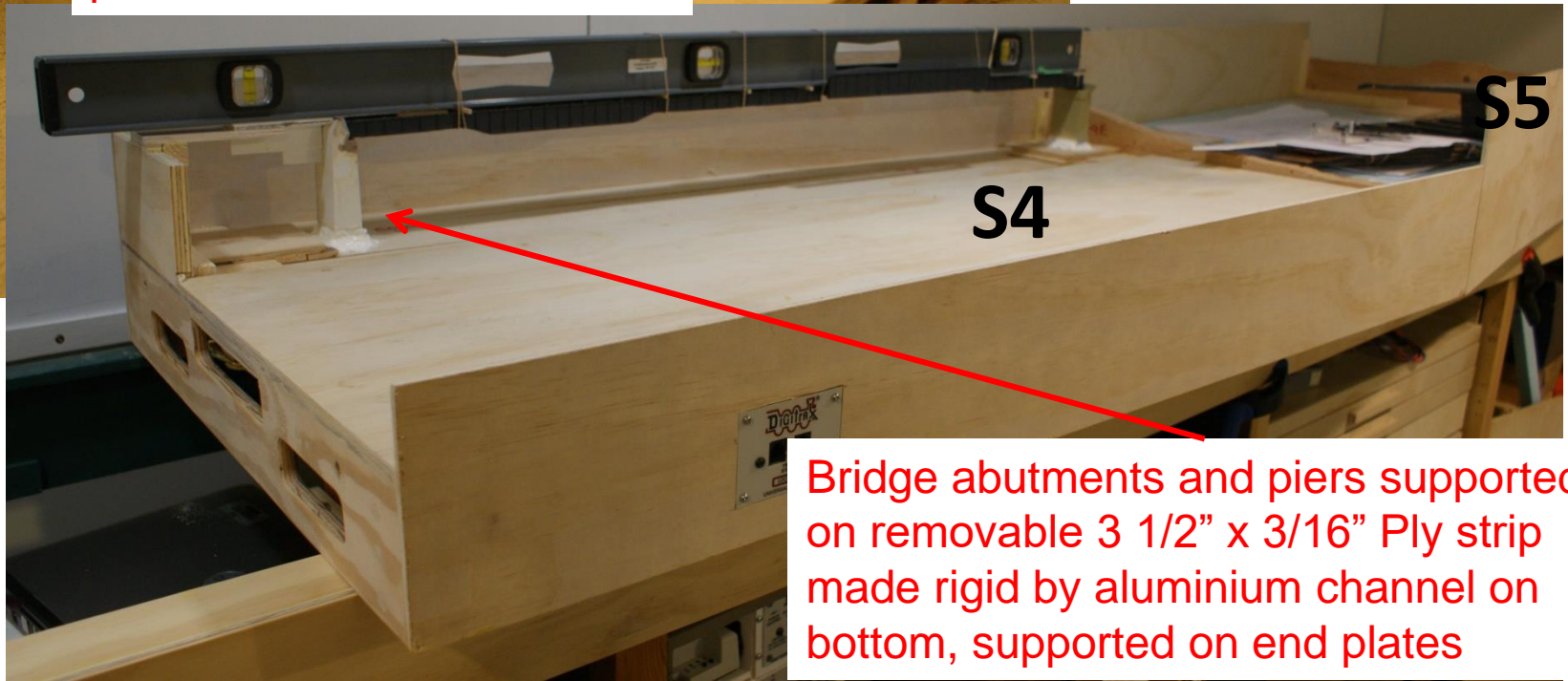
- Add roadbed and track
  - Attach/ level adjoining module(s) with glue barrier (grocery bag plastic) between ends
  - Ensure/ adjust so surface across joint is even
  - Add subroadbed of ¼” ply across joint
  - Lay roadbed and track across joint. Planning ensures turnouts are not on joint!!!
  - Use beam structure for sub-roadbed where appropriate
  - Use PC ties at section end butt joints to ensure robustness
  - Cut subroadbed, roadbed, and track with razor saw

# Sub-Roadbed

Every section is different!!!

S3

T-Beam (2" x 3/16" Ply web and flange) sub-roadbed supported on end profile plates



S5

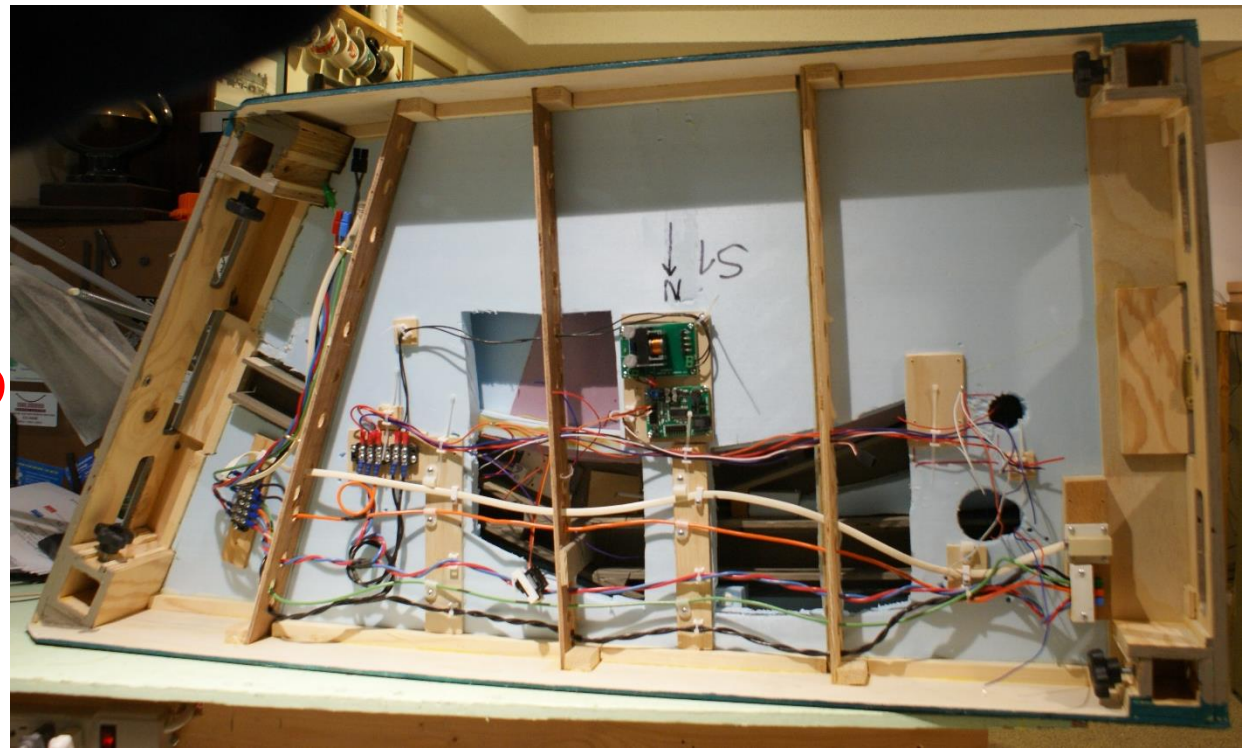
S4

Bridge abutments and piers supported on removable 3 1/2" x 3/16" Ply strip made rigid by aluminium channel on bottom, supported on end plates

# Build Process (4)

- Add wiring
  - Connectors or terminal blocks across section joint depending on anticipated frequency of separation
  - Install basic electrical infrastructure (buses, etc) first
  - Wiring easiest if section set on side on workbench

***Would you rather be looking UP at this?***



# Recessed panels for protection on workbench (and in operation)

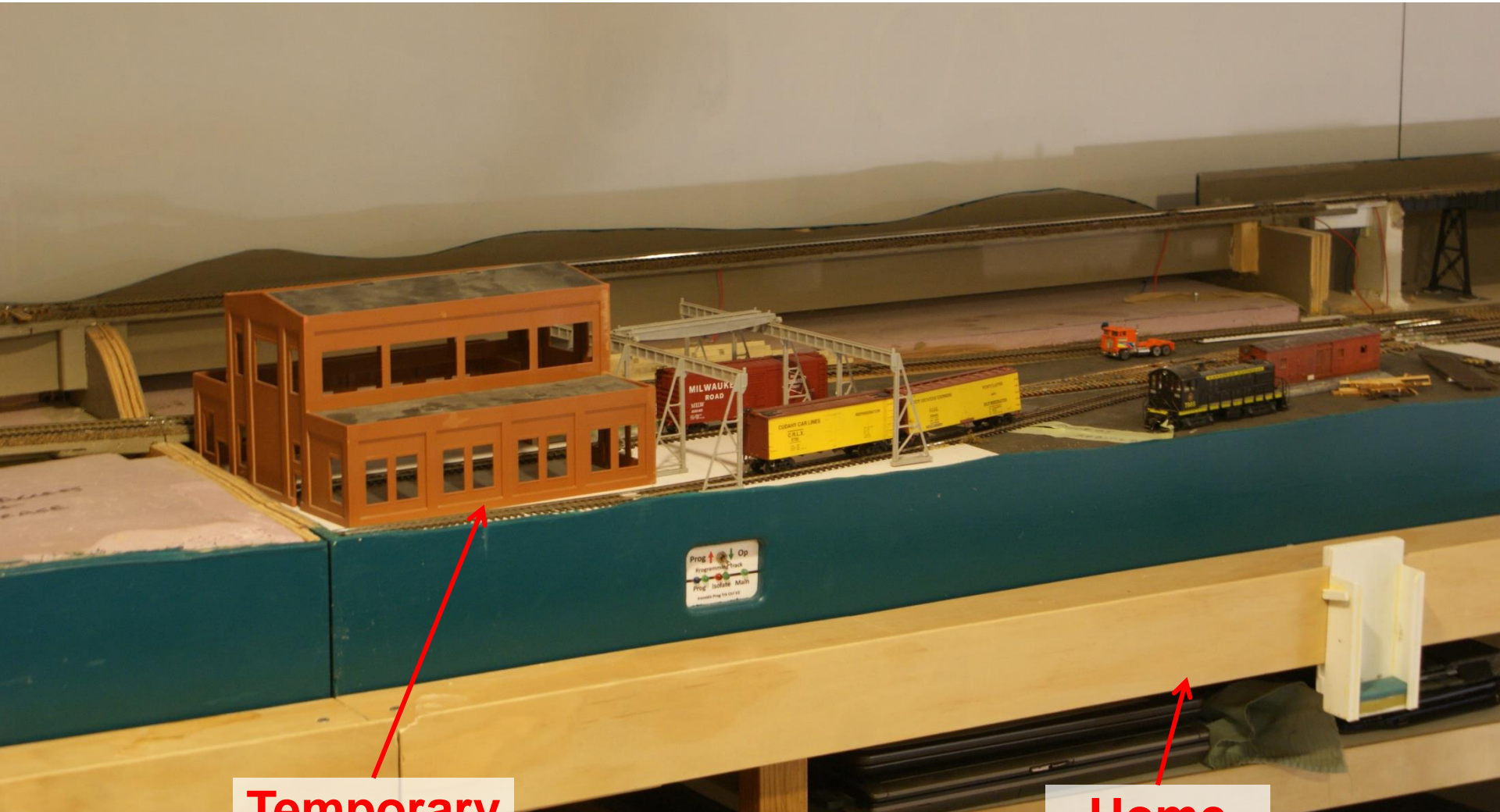


# Build Process (5)

- Add Scenery
  - Use foam for scenery base. Foam is light, and allows 'negative' scenery like ditches and ponds
  - Only top surface needs to be fully covered. Inside/middle layers can be at edges only
  - Cut end and side profiles if not previously cut
  - Secure scenery materials and structures well, since section will be set on side or end
  - Tall or fragile structures removable for transport or for working on section

**DONE!!!!**

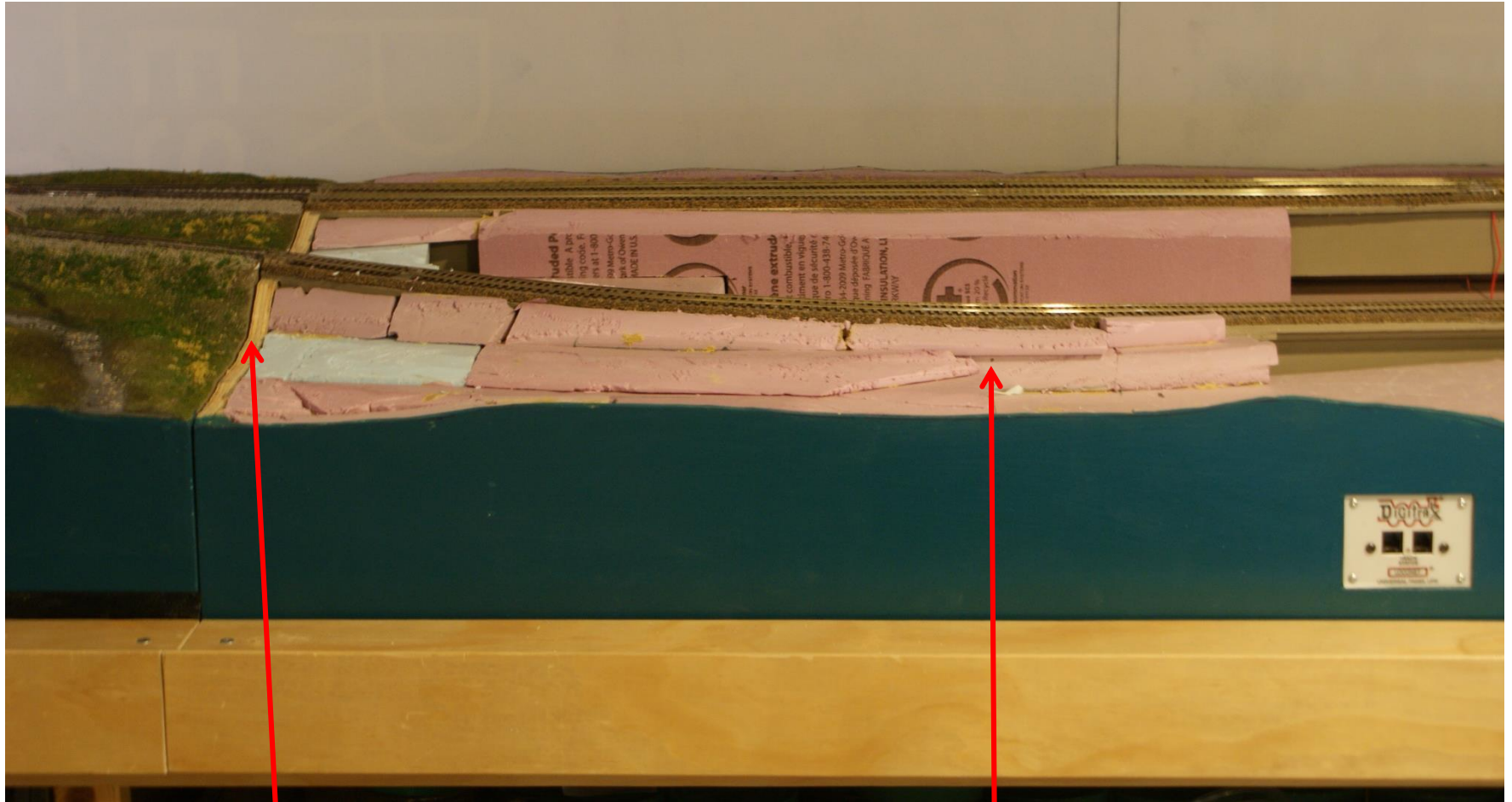
# Concept Scenery



**Temporary  
buildings**

**Home  
Bench**

# Started Scenery



**End  
Profile**

**Patched together  
foam chunks**

# Partial Scenery



**Pet Pterodactyl**

# Access to proper tools required

**Groups are Good**

**Someone has the  
tools or skills  
you lack**

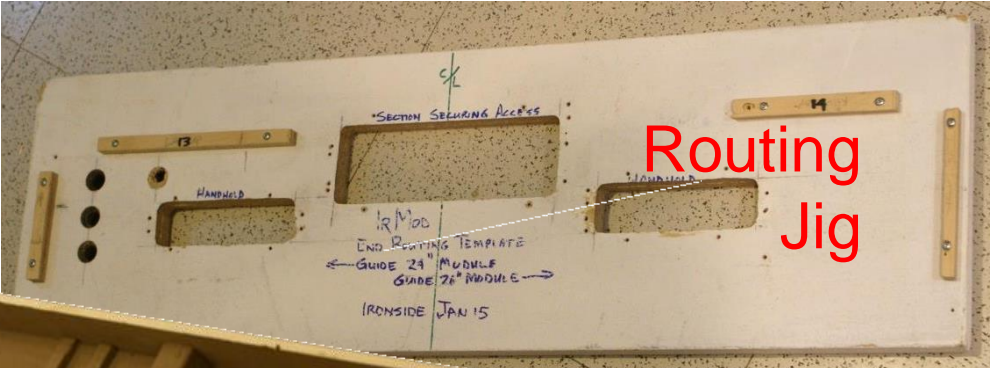
- Standard Tools

- Table saw
- Cross compound or chop saw
- Drill press
- Router with top/ bottom guided bits
- Clamps (lots of them)
- Squares/ Right Angle clamping fixtures

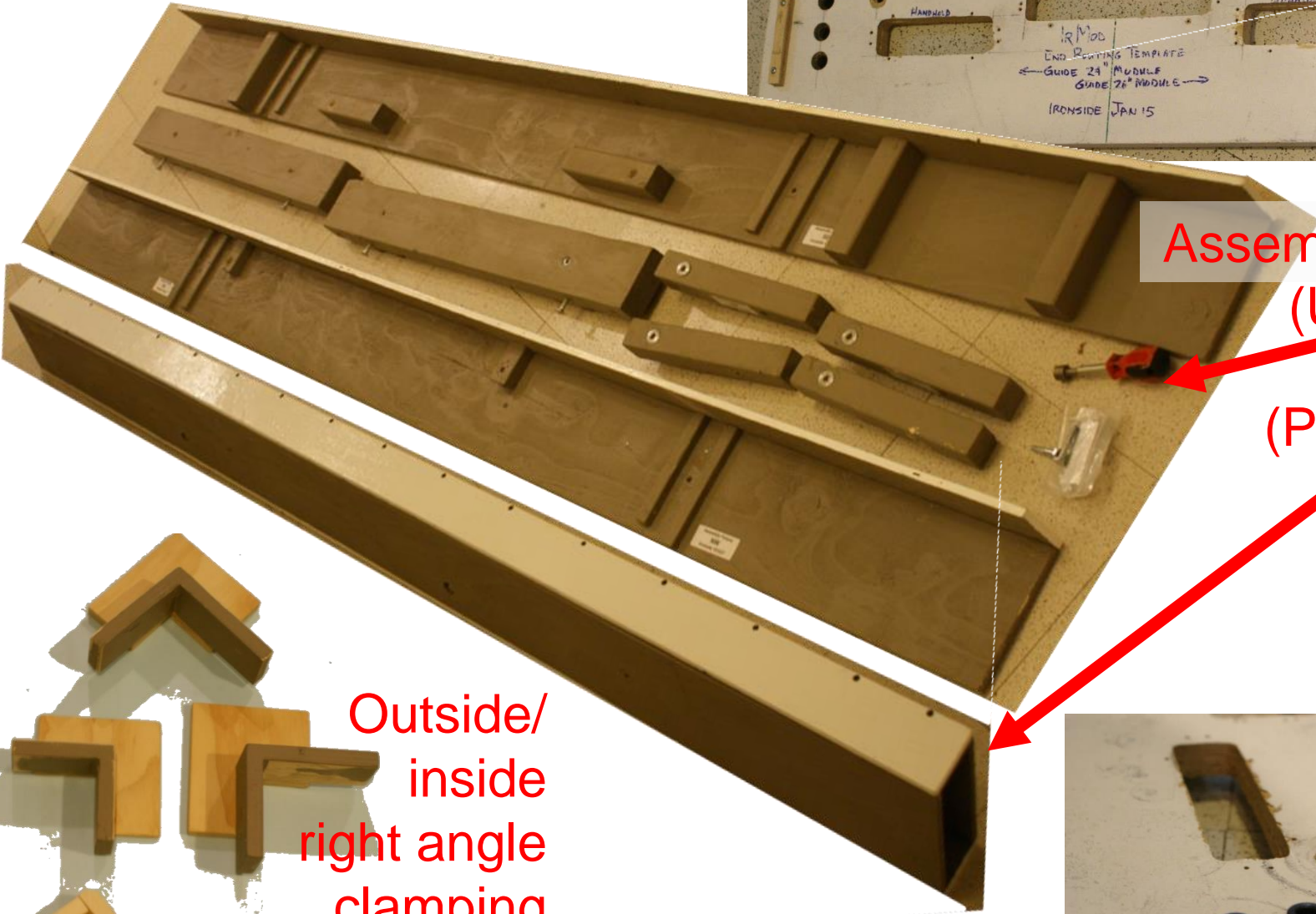
- Special Tools

- Routing jig (for end handholds and latch holes)
- Drilling jigs (for dowels, end plates, and coffins)
- Assembly fixture (for ensuring flatness and perpendicular surfaces when gluing)

# Special Tools



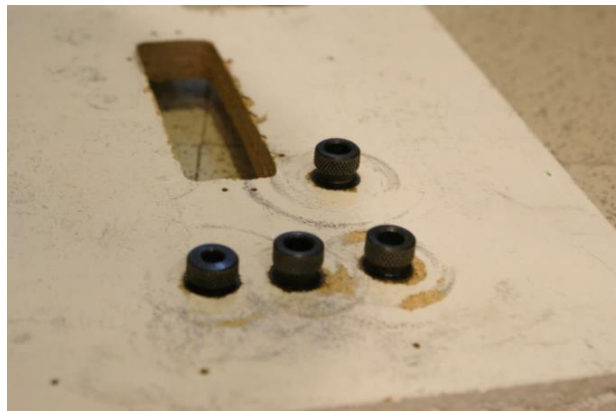
Routing Jig



Assembly Fixture (Unpacked)

(Packed)

Drilling Jig



Outside/inside right angle clamping jigs



# Assembly

*Glue, clamp  
and wait*

*then*

*Glue, clamp*

*and wait*



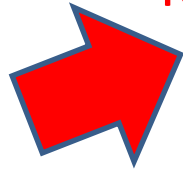
# Coffins

- If moving sections becomes a habit, use coffins for protection
  - Include weight in calculations of moveable sections
  - If sections not permanently stored in coffins, consider flatpack coffin approach
  - Consider if only top or all around protection needed

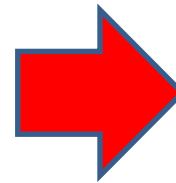


# Flatpack Coffin

As flatpack



Ten minutes later

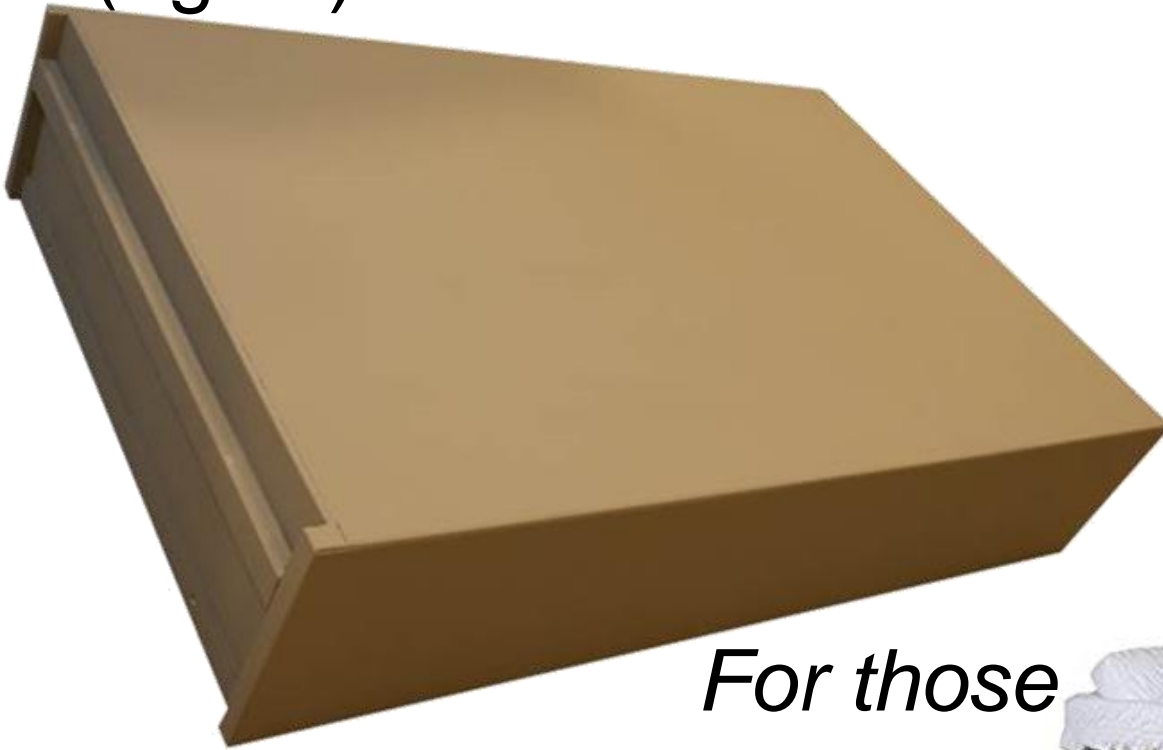


Assembled



# Fully Enclosed Fixed Coffin

- Can also be light weight
- Strength through structure (again)



*For those  
special  
sections*



# Weight Comparison

- Old section, old approach
  - S1 (4 feet): N/K
  - S2 (4 feet): 13100g
  - S3 (4 feet): 14100g
  - S4 (4 feet): 17415g
  - S5 (4 feet): 12700g
  - S6 (1 foot): 4855g
  - S7 (2 feet): 8600g
- New section, new approach
  - 6100g/ N/K
  - 7300g/ **-44%**
  - 7000g/ **-50%**
  - 8200g/ **-53%**
  - 6500g/ **-49%**
  - 3300g/ **-17%**
  - 5000g/ **-42%**

Predicted weight based on measurement of unfinished section, and addition of same weight for electrical as in old section, plus ~500g per foot for scenery.

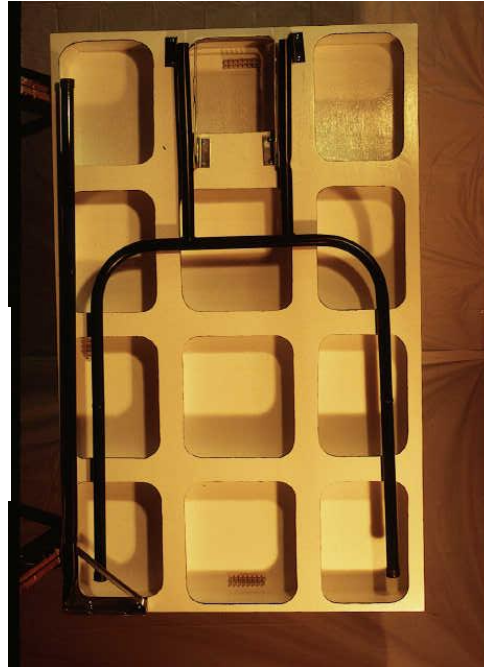
Weight does not include legs or coffin

# Alternative Light Weight Approaches

## Waffle

- Lightweight materials
- Very strong, rigid
- More complex

*The Sipping & Switching Society of N.C*

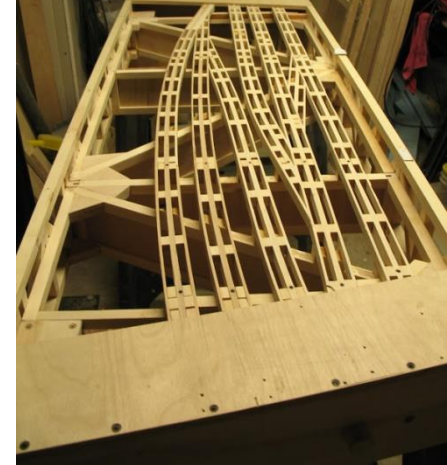


*Frank Wilhem Palouse*



## Truss

- Light
- Cabinetry skill level



## Foam Top

- Light
- Unbraced
- Durability/ stability question open



# Conclusions

- **Lightweight but robust Sections possible**
- **Not same as 'modular'**
- **Use structure, not mass, for strength**
- **Approach neither trivial nor fast**

**PLANNING is key**

- **Major benefits:**
  - **Non-destructive move from house to house**
  - **Easy transport and set up for portable layouts**
  - **Build and maintain at workbench**
  - **Incremental motivation**



# Finger Poking Time

Presentation slides available on  
[www.calgarymodelrailway.ca/](http://www.calgarymodelrailway.ca/)

Contact me at  
[IronsideJim@gmail.com](mailto:IronsideJim@gmail.com)