

# Practical Track Planning for Operation and Enjoyment

*Graeme Barnes, principal of Track Planning Services, describes the development of the track plan for the 'Armidale, Dangarsleigh and Long Flat Line', originally given as a formal address at the 2016 New England Model Railway Club (NEMRC) convention. Illustrations by the author.*

Some model railway layouts start at a distinct point in time. The design for this layout is one that was arrived at because of an invitation to give a presentation at the New England Model Railway Club (NEMRC) 2016 convention. I questioned what I could present to modellers that would have impact, as well as provide a worthwhile and interesting experience. I owe the inspiration for this design to the 'well-known' member of the hobby 'Raleigh Modlar'. He was the driving force for the idea for the plan and selection of 'The Dangarsleigh Room' at the Armidale convention site.

## Before Starting

There are a few common principles that drive the initiation of a model railway layout. There must be an idea in the mind for a railway, inspired perhaps by childhood memories, where one grew up, or an experience from a railway journey, magazine article(s), or the influence of a friend/relative.

The idea must be self-evidently satisfying; otherwise it is easily extinguished with doubts or misgivings. For many people, the idea is often and soon taken over by another more inspiring idea (often a problem for those referred to as 'armchair modellers'!) Without the conviction to make a start on a layout, the next idea is always better, but the layout never gets started.

To come to fruition there also needs to be an identified space to build a layout. Every modeller must come to terms with the reality of their space [Ron's Law of Railway Modelling: "The layout you want to build is always 10% bigger than the space you have to build it in" – Editor] In Australia the large shed in the yard, with air conditioning, lounge area, workshop, refrigerator, etc. is the archetypal dream. Reality is usually different from this dream. Often our available space is a hallway, spare bedroom, part of a garage, a covered veranda, etc. If this is what we have, this is what we work with! Available space for most modellers is usually about 5-20m<sup>2</sup>. Examples of typical modelling space are shown in Table 1.

Description of Space	Dimensions of Space	Area m <sup>2</sup>
1 sheet ply	1.2 x 2.4m	2.88
2 sheets ply	2 Sheets 1.2 x 2.4m	5.76
End section single garage	1.53 x 3m	4.95
Small single bedroom	3.3 x 3.3m	10.89
Large bedroom	3.6 x 4.2m	15.12
Single garage	3.3 x 6.0m	19.80

Our response to the desire to build our layout in the space available has consequences. We compensate for the size of our models and we condense our ideas for the reality of the space available. Railway modelling is a juggling act in which we give up some aspects of our dream to make the layout happen. The practical factors that we incorporate into clever design for a model railroad are addressed in this article.

*"... a model railroad layout starts with a desire to create something from our imagination to satisfy our need to see trains running through a landscape of our dreaming ..."*  
GB

## Some Practical Considerations for Good Design

*"An idea for a railway in the mind"*

The vision, operating concepts, wants and needs of a modeller before starting design of a layout are important for the long-term enjoyment of the layout. Writing down and committing all the likes and dislikes for a layout is a key element for success to complete a model railway. Even though our ideas change as we gain experience, or just simply a desire to modify our original plan for perceived improvement, a written plan is critical for creating a starting point.

Here are some (but not all) reflections before putting pen to paper.

- The space available: our limitations.
- Does size matter? Big is not best and small is often enough.
- Aisle widths to fit our size and shape.
- Reaching into the layout.
- Zero height – to provide for our assorted sizes and shapes. There is no single answer to height.
- Graded elevation for increased operating opportunities.
- Track curvature – limited by space available and our ability to reach across oversize curves.
- Coach and wagon storage. A question of whether we want our rolling stock on the layout, in boxes under the layout or hidden in another room or out of sight in staging areas.
- Train length. Limitation of what we view at any one time. In real life we rarely see all the train passing before us.
- Operation. How many trains can we control at one time?
- Planning grid.
- Track, turnouts and inventory.
- Edges of benchwork; location and shape.
- Wyes (triangles) or turntables? Turning whole trains or just individual rolling stock.
- Scenic dividers.

## Preparing a Visualisation of the Layout

*"Seeing the layout"*

The design of any layout is presented as a two-dimensional plan. Later, each design could end up as a living, breathing three-dimensional finished product. The conversion of the 2D concept to something each modeller would love in his space is up to the modeller.

The problem in converting the 2D plan into the layout of our dreams is greater for some than others. We are not all adept at visualising how a plan can be converted into a layout. Some people are simply not good at 'seeing' a 2D plan as a fully operational 3D product. This ability to be 'spatially aware' is part of the differences between us as human beings.

## The Idea for a Demonstration Layout

*"An identified space to build a layout"*

The Dangarsleigh Room, used at the 2016 Armidale convention, had many worthwhile features making it ideal for a substantial layout [Images 1 and 2]:

- A fully-lined rectangular room 11.24m x 5.11m
- Area of the room is 57.44m<sup>2</sup> [this is a medium to large space for a layout]
- Good overhead lighting and air-conditioned for reliable operation

- Glass bifold doors in one of the narrow ends (north wall)
  - Sliding door entry through a 1.7m opening on the west wall
- For design purposes other entrances are ignored.

The frosted glass wall at one end gives casual visitors a glimpse into the unfolding experience of a model railway.

### Conception of a Plan

#### *The Armidale, Dangarsleigh and Long Flat Line*

The AD&LF is one of those iconic, if imaginary, treasures of the New England area. Historically a diverse line, the AD&LF has operated for what seems an eternity, from Armidale to the seaport of Port Macquarie. Socially, culturally and economically these important centres are a neat and complementary pair of Australia's best country cities!

This is a 'bridging' line (to use American terminology) carrying a wide variety of rural and other products between both centres. Passenger traffic has always been important for the management of the line; business travellers, workers, tourists and holiday makers have made travel in both directions important to the overall operation of the line. The AD&LF joins the sea to the high country.

When the line was first contemplated, it seemed that crossing the Great Dividing Range would pose a problem, but the brilliant engineers of the NEMRC found a way through the grazing country east of Armidale, through Dangarsleigh and Yarrowitch and over the escarpment into the Hastings Valley, passing through Long Flat and along the Hastings River into Port Macquarie.

Raleigh Modlar (RM) had made many requests of the designers before settling on his choice of the route between the two cities. After many initial plans were drawn RM selected option 'E' for its all-encompassing appeal, service to the region and long-term potential for a successful, profitable business future.

The AD&LF is essentially an 'around the room' layout with a large central peninsula. In plan view the layout represents a large misshapen 'E'. The central peninsula juts into the room towards the glass wall and provides enough width for Armidale and Port Macquarie terminals to be placed back to back on the peninsula, visually separated by a central divider.

The design [Images 3 and 4] provides continuous running with large end loops giving long stretches of open country running (bypassing the terminals as required). The plan incorporates many branch lines to smaller country centres with a rail service transporting all manner of goods and passengers throughout the network and to the big cities. Timetables provide for a multitude of efficient and integrated freight and passenger operations. Whole trains can be turned on the wye joining the great loop to the Work Shop. Once in the staging and repair lines of the Work Shop, RM can tinker and repair rolling stock while rail operations continue throughout his system.

### A Plan to Work With

Essential elements of the AD&LF were established before design of the layout began:

- HO scale.
- All curves 850mm radius.
- Minimum aisle width 1.0m.
- Maximum reach into layout 800mm.
- Continuous running: Main line 50.06m (shown on the plans as the blue track).
- Some double track running.
- Total track 179.78m, 110 turnouts.
- End-to-end branch lines.
- Rural and urban localities, industries, sea port.
- Armidale terminal.



*The Dangarsleigh Room in Armidale; site of the New England Model Railway Club 2016 convention. An ideal sized room for a medium-sized layout and typical of the space available to many modellers. Image courtesy of Chris Estreich NEMRC.*

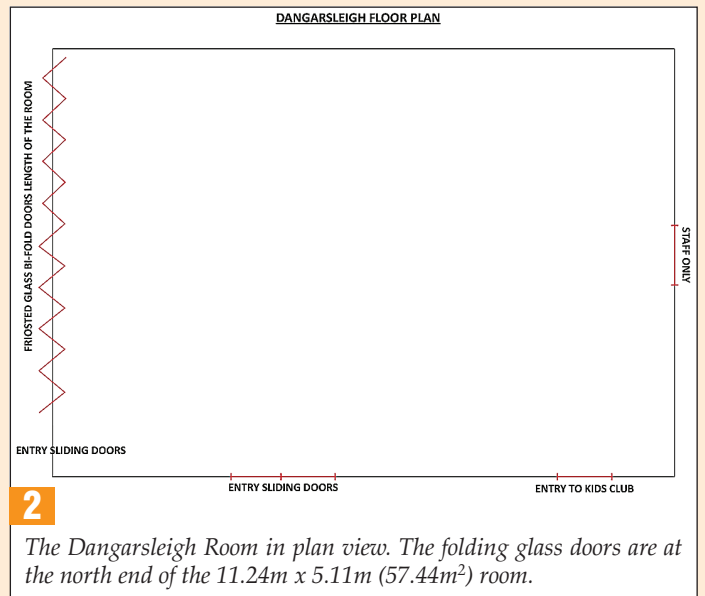
- Port Macquarie terminal.
- Swanvale; a well-known and iconic destination for members of the NEMRC.
- Long Flat on the banks of the Hastings River.
- Bulga plateau; a place for the finest milk products.
- Wally Carr, Cedar Tops, Yarrowitch and Dangarsleigh in the high grazing country.
- Work Shop Line: a place for RM to sit and work at a bench, yet, part of a terminal line for repair, storage and programming of rolling stock.
- Sections of elevated track rising from 'zero' level to 325mm.
- Gradients from 0.9% to 3.1% (1 in 110 to 1 in 32).
- Triangles (wyes) with the capacity to turn entire trains.

The two large loops require access hatches to enable construction near the walls and to provide future access. The hatches provide more landscaping opportunities.

On the plans all bench edges are shown as orange lines.

### A Trip Around the Layout

The charming city of Armidale is located on one side of the central peninsula in the middle of the layout room. It is an



*The Dangarsleigh Room in plan view. The folding glass doors are at the north end of the 11.24m x 5.11m (57.44m<sup>2</sup>) room.*

# TRACK PLANNING SERVICES

To help us understand your modelling goals, and to help you focus on those aspects of the hobby that are important to you, please select features from the following tables.

Make any additional comments about your goals in the space below.

Thanks from the team at

## TRACK PLANNING SERVICES

Modelling Scale	✓
HO	✓
N	
O	
Z	
S	
TT	
HO <sub>n</sub>	

Prototype: *NSW 1940 - 1960*  
 Brand and track code: *Peco 100*  
 Minimum curve radius: *600+*  
 Single/double track:  
*Single OK*  
*Double - as much as possible for mainline passenger service*

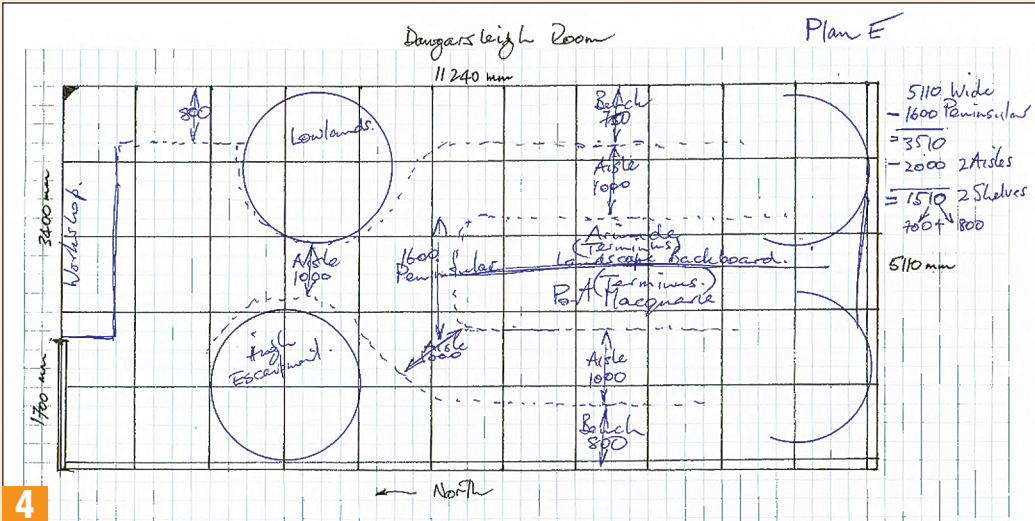
**Graeme BARNES**  
 greybee@optusnet.com.au  
 Phone: 04 2740 0755  
 Fax: 02 6742 3902

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Operating Era	✓✓✓
Early Steam	
Late Steam	✓
Early Diesel	✓
Modern Diesel	
Transition Era (1955 - 1975)	
Your Era or Time Period =	<i>1940 - 1960</i>
Train Operation	✓✓✓
Mainline	✓✓✓
Continuous running	✓✓✓
Shunting	✓✓✓
Out and Back (Stub Terminal)	✓✓✓
Reverse Loop <i>not really necessary</i>	<i>2 ✓✓</i>
Turntable <i>probably</i>	<i>?</i>
Wye	✓✓✓
Single Mainline	✓✓✓
Double Mainline	✓✓✓
Multiple Urban Mainline	—
Engine Yard	✓✓✓
Freight Yard	✓✓✓
Passenger Yard	✓✓✓
Hidden staging yard	<i>No</i>
Operational Limits	#
Number of trains simultaneously running	<i>2-3</i>
Number of wagons in longest freight train	<i>?</i>
Number of coaches in longest passenger train	<i>?</i>

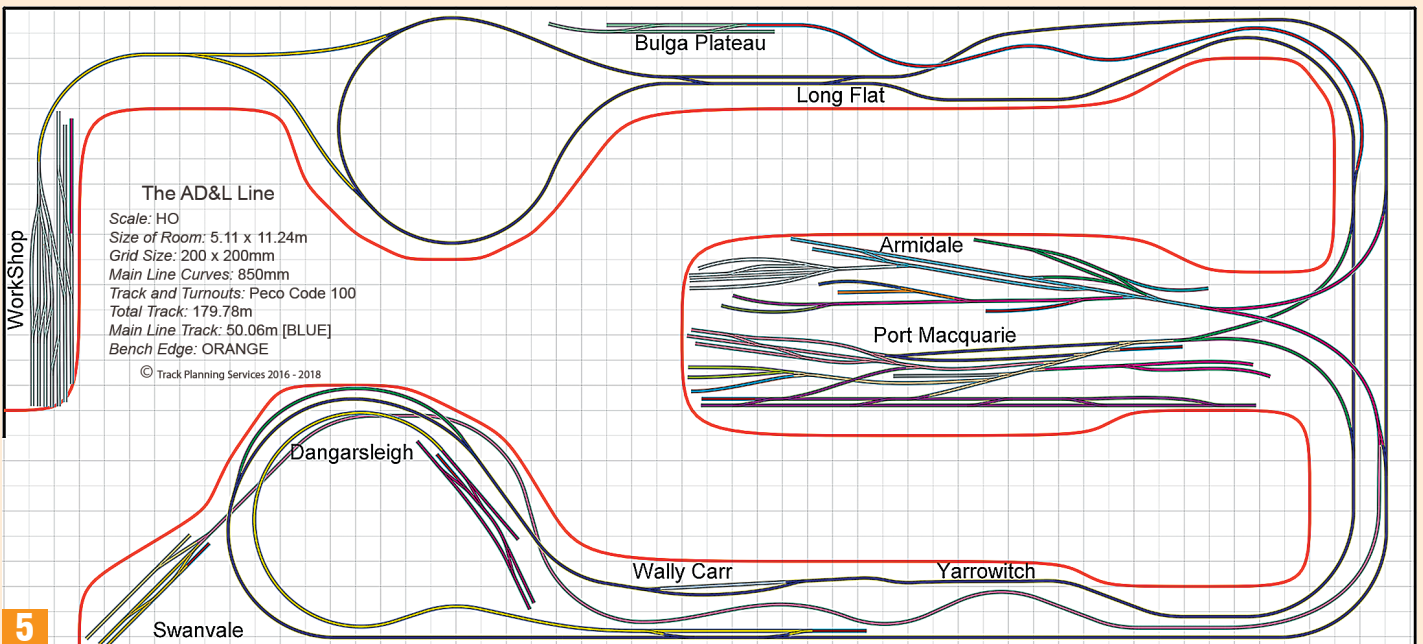
Railway Theme	
PASSENGER SERVICES	✓✓✓
Urban Passenger	✓✓✓
Long Distance Passenger	✓✓✓
Rural Passenger	✓✓✓
INDUSTRY	✓✓✓
General Freight	✓✓✓
Factory	✓✓✓
Ore processing	✓✓✓
Cement	✓✓✓
Refinery	✓✓✓
Product manufacturer	✓✓✓
Power plant	✓✓✓
Steel plant	✓✓✓
Livestock processing	✓✓✓
Warehousing	✓✓✓
BRANCHLINE	✓✓✓
Timber/logging <i>possible</i>	✓✓✓
Mining	✓✓✓
Engine servicing	✓✓✓
Grain	✓✓✓
Livestock	✓✓✓
Rural produce	✓✓✓
Farm produce	✓✓✓
Resort/leisure	—
Seaport <i>if possible</i>	—
Fishing	—
Railway maintenance	?

◀ A planning sheet is useful to help understand what is wanted on the layout, whether the plan is being prepared professionally or by the builder themselves. Before starting to design the layout, a clear picture of what is regarded as 'essential', along with what would be 'nice to have' and 'not necessary' is a very useful thing to have. The ideas for the layout can be recorded in 'black and white', plus notes made about specific requirements and non-required features can be ignored.



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◀ One of a series of hand-drawn ideas to see if RM's wishes can be accommodated in the space available. Concept "E" is the basis for the final CAD plan. The large grid lines are at 1m intervals. Large test circles for track are 2m diameter for a 1m gap between circles for aisles.



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The completed CAD plan of the layout.

important interchange city with north-south rail traffic between 'Sinney' and 'Brisbin' and the seaport line to Port Macquarie. Here are extensive carriage sidings, as well as marshalling and goods sidings. The rail precinct is a busy terminal for shunting a wide variety of rolling stock.

From the Armidale terminus, track begins rising towards the peaks of the New England region, passing through the distinctly rural centres of the high plains. Before the main line has travelled too far from Armidale, a diverging branch line begins its regular descent towards the small rural township of Swanvale. Passing under the towering curves of the main line the Swanvale branch disappears into the hills before heading towards its destination, near the glass wall entrance to the room.

Before the main line descends to breach the escarpment, a branch line rises on the aptly named Cedar Tops line into Dangarsleigh. This is the high point of the layout at 325mm, also facing the entrance to the layout room.

Back on the main, the line passes through the old village of Wally Carr, reputed to contain Australia's oldest population. The line is descending to the coast, travelling through timbered and wooded landscapes of the escarpment. It snows in this region and the timbers and mid-storey trees and shrubs show their rugged nature for survival.

Down on the coastal hinterland, running is a lot easier towards Long Flat. Before reaching this delightful riverside town, there is a diverging track to another terminus at Bulga; rich dairy country on its own high plateau. Bulga sits overlooking the run through Long Flat and trackage heading around the loop towards the distant seaport.

On this great loop, track takes off towards the Work Shop; the site of all RM's efforts to maintain his rolling stock and the centre of his struggles to maintain and improve his empire. The Work Shop line extends across the glass wall of the room.

After circumnavigating the great loop, the main travels a considerable distance to Port Macquarie. Here the line provides shunting and storage services to many dedicated freight businesses and rail passengers. Along the harbour, ships are waiting to receive rail loads for foreign and local ports [Image 5].

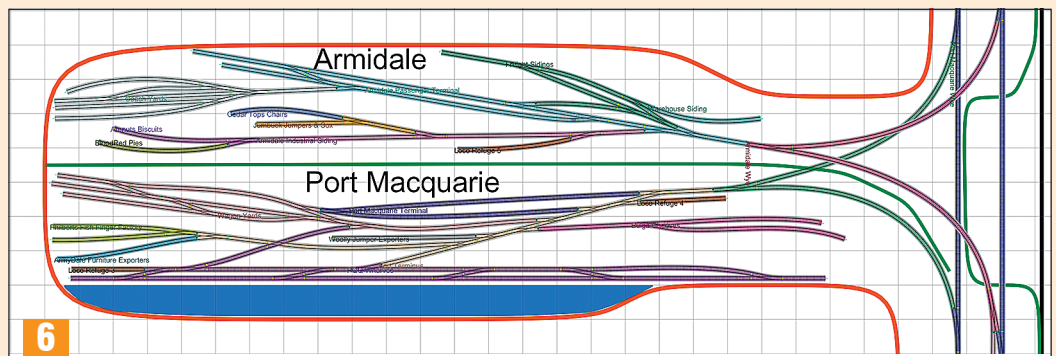
### Significant Passenger and Freight Operations

Some, but not all, operations are outlined here:

#### Passenger Traffic

- Armidale/Port Macquarie long distance traffic
- Local traffic for the rural stations at Wally Carr, Long Flat, the Work Shop, Dangarsleigh loop and Swanvale
- Carriage sidings provided at Armidale and the Work Shop.

#### Industries/freight offering at the major termini [Image 6]



The major cities of Armidale and Port Macquarie on the central island benchwork, shown on a 200mm x 200mm grid. This section of the plan shows the myriad opportunities for shunting at both centres. The harbour at Port Macquarie can accommodate models of ocean-going ships next to the wharf, giving both an interesting scenic feature and a 'destination/starting point' for traffic on the railway. The main line is marked in blue, while the backdrop dividing the cities is green; refer to Table 4 for the colours indicating the other sidings and operational areas.

#### Industries/freight offering at the intermediate locations

- Grain silos at Swanvale
- Dairy sidings at Bulga
- Timber from Cedar Tops

#### Elevation for Interest

Armidale and Port Macquarie are separated by a landscape backboard on a central peninsula, but are at different heights to reflect their relative difference in altitude (Armidale is 100mm above the 'zero' height of Port Macquarie). The main line is designed for clockwise running, but is essentially a bidirectional single track. To allow for passing on the main, loops are placed at strategic locations. However, much of the main line is graded. The loops are designed as flat lengths of track, even though they are in elevated country. These flat loops are a safety measure to counter run-aways.

The track to Cedar Tops rises at 3.1% (1 in 32) to reach Dangarsleigh at 325mm above 'zero' height. At Cedar Tops all rail is level for safe shunting conditions. Further along the main line Wally Carr is at 150mm elevation, with the station's island platform on level ground.

The Swanvale branch rises from zero height at a regular 1.2% (1 in 83) grade to join the main line into Armidale.

From Port Macquarie the main line traverses the hinterland plains through Long Flat before rising 0.9% (1 in 110) to the Work Shop Wye at 75mm above 'zero'. From the Work Shop Wye into the Work Shops the line rises a further 25mm to provide increased clearance above RM's workbench. Another branch from Port Macquarie to Bulga Plateau rises at 1 in 38 (2.6%) to 150mm before levelling out at the thriving community of Bulga.

Image 7 gives an idea of how the various areas are separated by height.

#### Landscaping

Landscaping turns a piece of track into an artistic delight. This is the realm of the modeller to create something from his dreams. Every modeller looks at a plan through different eyes and with guarded expectations of themselves.

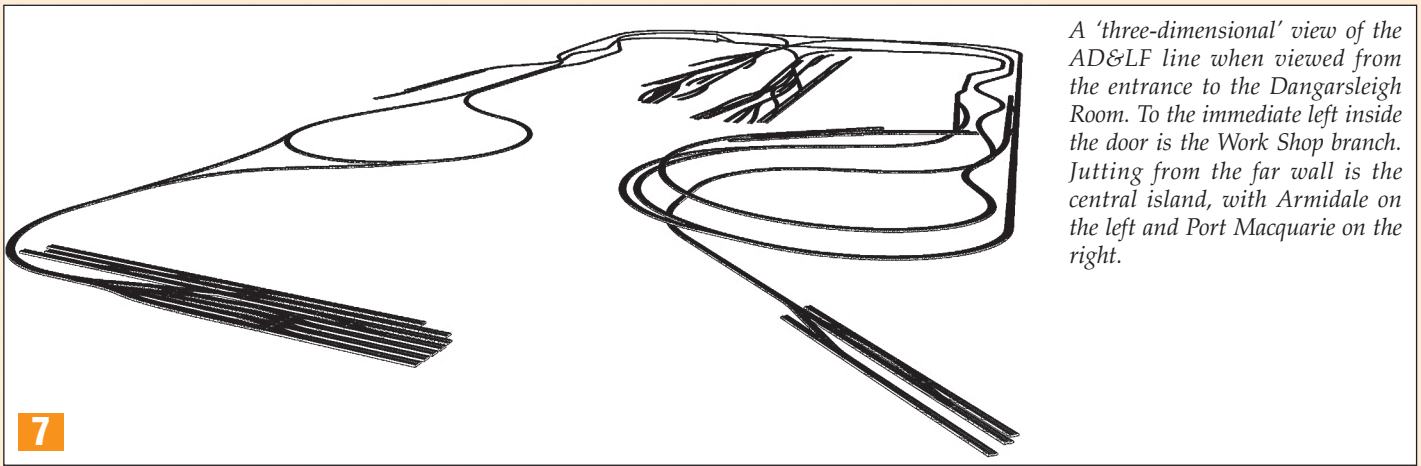
This plan simply indicates 'view blocks' (the green lines) for RM to understand that the plan can be broken into a number of discrete scenes [Image 8]. The most obvious landscape components are the backboards running around the room behind the track and splitting the towns of Armidale and Port Macquarie on the peninsula.

The rest of the landscaping is up to RM! Here are some suggestions:

Near the room entrance, the Swanvale Branch disappears into a tunnel under the towering mountain face, rising to Dangarsleigh Loop. Up above, the cliff sides and Cedar Tops line rises from a cutting before exiting to the heavily timbered peak above Dangarsleigh

In Port Macquarie many structures are required for passenger,

Armidale	Port Macquarie
Arenuts Biscuits	Jumbuck Jumpers and Sox
Blood Red Pies	Philibert's Fish Finger Factory
Cedar Tops Chairs	Army Dale Furniture Exporters
Public goods yard	PQQ Wharves
Armidale industrial sidings	Bulga Cheeses
	Public goods yard
	Marshalling yard



A 'three-dimensional' view of the AD&LF line when viewed from the entrance to the Dangarsleigh Room. To the immediate left inside the door is the Work Shop branch. Jutting from the far wall is the central island, with Armidale on the left and Port Macquarie on the right.

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freight and manufacturing industries. Some of these structures may be strategically placed to block other aspects of the town, until the viewer shifts position to reveal another scene.

To scenically separate Long Flat and the Bulga plateau may only require timbered hillsides and a bridge over the main line (as the branch curves away from the bench edge).

The extensive nature of the design and the various grades provide opportunities for hidden track, cuttings and tunnels.

### Track Inventory and Placement

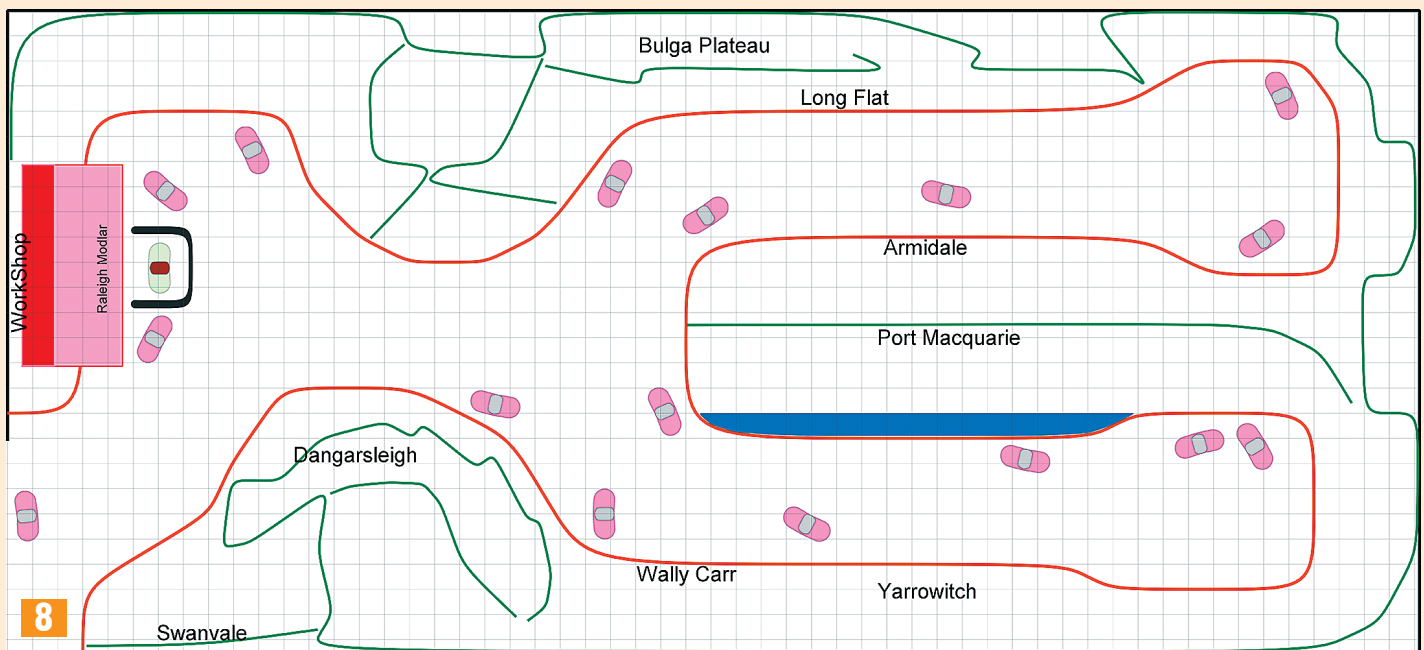
With an area of over 55m<sup>2</sup> this is a medium to large layout. The precise location of the turnouts and curves is essential. In this plan, plain turnouts are preferred, while curved turnouts and double slips are avoided. The grid for layouts developed by Track Planning Services (the author's company) is 200mm x 200mm. This is a useful grid as it approximates a typical hand span. The table of track and turnout inventory gives all information for hardware. Each turnout part number is also indicated on the plan.

In designing the layout care has been taken to place turnouts in accessible locations. In general, turnouts are placed within 800mm of benchwork edges for easy reach in case of derailments or turnout failure. Loco refuges and run-around necks are designed with the length of the longest locomotive working in the area in mind.

Another plan locates centres of all (regular) curves. Regular

curves in the layout are 850mm radius. Where there is parallel track, the outer track is 902mm radius with the same centre point.

HO Peco Streamline Code 100	Length	Quantity
SL-100 Flex 914.5mm. (wood)	136m	149
SL-88 Right turnout	257mm	8
SL-89 Left turnout	257mm	10
SL-91 Right turnout	184mm	44
SL-92 Left turnout	184mm 184mm	44
SL-93 Crossing	127mm	1
SL-94 Crossing	248mm	1
SL-99 Threeway turnout	219mm	2
Total track length	180m	



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The outline of the baseboard is shown in orange and the locations of the scenery breaks are shown in green. The track is not shown for clarity. Scenery breaks isolate the layout into viewing blocks. These breaks can take many forms, such as trees and other vegetation; topographic features such as cuttings, banks, escarpments, low hills; structures, bridges, townscapes, etc. The object is to create distinct and separate points of view as operators and visitors move around the layout room.

## Identification of Sections of Track

As an aid to RM, his plans are produced in colour to identify each line of the railway (see Table 4). Each branch line, all sidings, including carriage sidings and freight yards, and all other sections of track are colour-coded. This is of particular benefit when wiring and planning operational routes around a layout of this size.

The table also indicated the length of track in each section – information for laying track and assessing the number of pieces of rolling stock that can fit into each siding.

## The Future for the Layout

The AD&LF line is a design produced to a wish list for RM. Not all ‘wishes’ have been able to be incorporated into the plan (e.g. ore processing was desirable, but had to be replaced with timber getting for Cedar Tops Chairs). A locomotive depot, with servicing facilities, and possibly a turntable and roundhouse, could be incorporated into the design (using the area within the

great loop near the Work Shop Wye). It is possible to build and fit reasonable curves within the loop at some later stage, however the access hatch may need to be sacrificed, causing issues reaching to the rear of the layout.

Further lineside industries are possible, e.g. stock loading near Long Flat, construction of an abattoir along the main line between Wally Carr and the Armidale Wye. The design of this layout provides significant long distance running and plenty of opportunity for shunting for the movement of goods wagons and passenger carriages.

The AD&LF line was never meant to be a ‘nuts and bolts’ Australian layout modelling real locations. Rather it is an attempt to demonstrate that taking a ‘what-if’ approach and designing a layout to suit the individual ‘Raleigh Modlar’, taking into account that modeller’s personal preferences, can result in a layout that is very satisfying to build and operate and is likely to sustain the interest of the individual RM for a very long time. 🟩

**Table 4. Identification of Sections of Track by Colour**

Track Section	Colour on Plan	Length	Track Section	Colour on Plan	Length
Arenuts Biscuits	bright pink	1.04m	Loco Refuge 3	brown	0.43m
Armidale Industrial Siding	rose	2.63m	Loco Refuge 4	brown	0.50m
Armidale Passenger Terminal	turquoise	6.70m	Loco Refuge 5	brown	0.67m
Armidale Wye	pink	4.04m	Loco Refuge 6	brown	0.43m
Army Dale Furniture Exporters	dark teal	0.83m	Main Line	blue	50.08m
Blood Red Pies	khaki	0.77m	PQQ Wharves	bright pink	10.88m
Bulga Cheeses	pink	2.90m	Philibert’s Fish Finger Factory	dark lime	1.69m
Bulga Dairy Sidings	pale green	3.79m	Port Macquarie Terminal	purple	3.38m
Bulga Plateau Branch	red	5.79m	Port Macquarie Wye	mid green	3.50m
Cedar Tops	plum	4.84m	Port Terminus	tan	4.93m
Cedar Tops Branch	yellow	7.41m	Station Loop	sky blue	1.00m
Cedar Tops Chairs	mid blue	0.66m	Swanvale Branch	rose pink	11.98m
Coach Yards	light turquoise	5.94m	Swanvale Silos	pale yellow	1.60m
DCC Program Track	plum	0.91m	Swanvale Station and Yards	dark tan	2.76m
Dangarsleigh Loop	green	2.19m	Wagon Yards	cerise	7.22m
Freight Sidings	dark green	3.36m	Warehouse Siding	teal	0.65m
Jumbuck Jumpers & Sox	yellow ochre	1.12m	Woolly Jumper Exporters	grey	0.84m
Loco Refuge 1	brown	0.25m	Work Shop Line	aqua	16.68m
Loco Refuge 2	brown	0.25m	Work Shop Wye	dark yellow	5.12m

