



Reference material

Aspect Sequences with High Speed Turnouts

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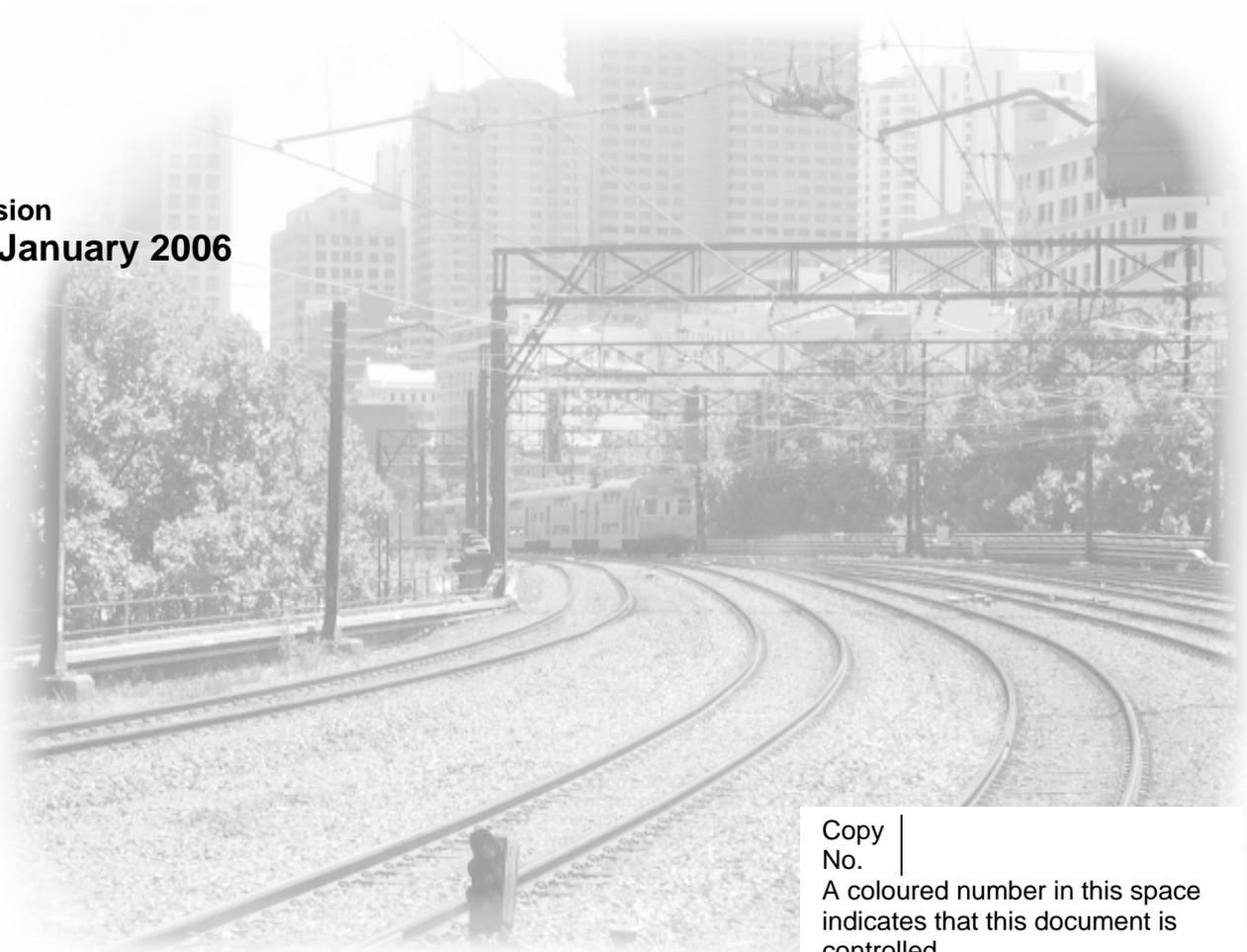
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Signal Engineering

Aspect Sequences with High Speed Turnouts

Design Guideline

Version
16 January 2006



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Aspect Sequences with High Speed Turnouts

Design Guideline

Version
16 January 2006

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TABLE OF CONTENTS

1	INTRODUCTION	4
2	CURRENT DESIGN PHILOSOPHIES	4
2.1	Junctions of Equal Speed.....	4
2.2	Reduced Speed Turnouts.....	4
3	DRIVER INTERPRETATION OF TURNOUT ASPECTS	4
3.1	Turnout Repeaters.....	4
4	PRELIMINARY MEDIUM INDICATIONS	5
5	ISSUES WITH HIGH SPEED TURNOUTS.....	5
5.1	Equal Speed Junctions.....	5
5.2	Turnouts with Speed Differentials.....	6
5.3	Inadequate Braking Distances Beyond Junctions	7
6	CONCLUSION	8

1 INTRODUCTION

The use of turnout repeaters and preliminary medium aspects have been introduced to assist drivers in the control of their trains through turnouts.

Usually, the turnout is a much lower speed than the prevailing line speed.

The introduction of higher speed turnouts changes the criteria that need to be considered in the application of a safe signal aspect sequence.

This document is to promote awareness of the issues and provide guidance for designers in the provision of the appropriate aspect sequence to drivers.

2 CURRENT DESIGN PHILOSOPHIES

The current arrangements have two main scenarios covered in the design principles.

The first is for equal speed junctions where clear aspects are provided both way, the other is where there is a difference in speed for either direction, and a top yellow is provided for the lower speed turnout direction.

2.1 Junctions of Equal Speed

In this arrangement normal aspect (ie straight route) sequences apply at the junction signal both routes.

A turnout repeater is provided on the signal before the junction signal. Because there is no difference in speed between the two routes, restrictive indications only display to provide the braking distance to a signal at stop.

The turnout repeater may not be at braking distance from the signal at the junction, and consequently the ability for drivers to "challenge the route" is not always possible.

2.2 Reduced Speed Turnouts

In this arrangement, reduced (medium and preliminary medium) aspects are displayed on the approach to a turnout, in conjunction with a turnout repeater.

It is not possible for the driver to distinguish the difference between a restrictive aspect for braking to a stop signal, as for braking to a turnout restriction.

3 DRIVER INTERPRETATION OF TURNOUT ASPECTS

3.1 Turnout Repeaters

The prime reason for a turnout repeater is so that drivers understand that the restrictive aspects being displayed are the result of a turnout and not a train ahead, which may imply a higher speed can be maintained.

The driver must know the speed of the turnout ahead.

With this arrangement braking distance is much less of an issue as with a low turnout speed, there is usually sufficient braking distance provided at the turnout speed past the signal.

However, if the turnout speed is high, care needs to be taken that braking distances past the turnout are adequately provided for.

4 PRELIMINARY MEDIUM INDICATIONS

Preliminary medium aspects with turnout repeater do not provide any information to the driver, except that by their inclusion, it permits a medium aspect to now positively identify a turnout signal as the next signal.

5 ISSUES WITH HIGH SPEED TURNOUTS

5.1 Equal Speed Junctions

Consider the following situation:

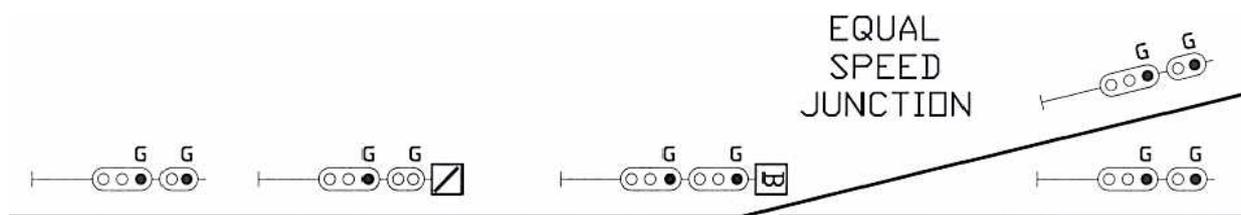


Fig 5.1 Equal Speed Junction – Clear Signals

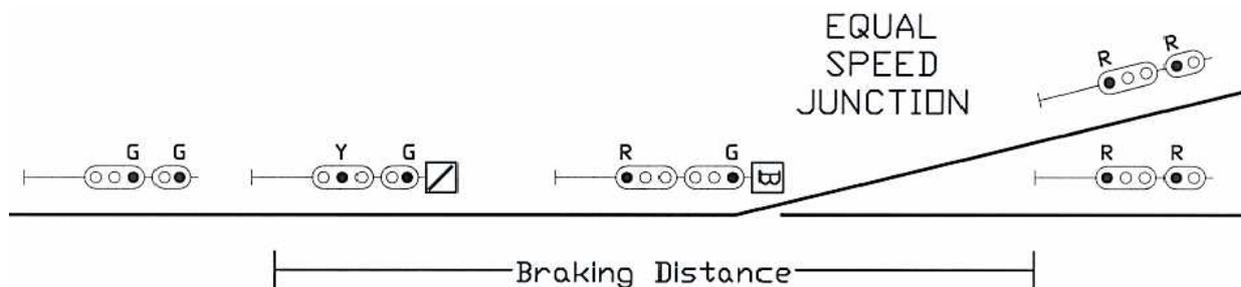


Fig 5.2 Equal Speed Junction – Signal at Stop

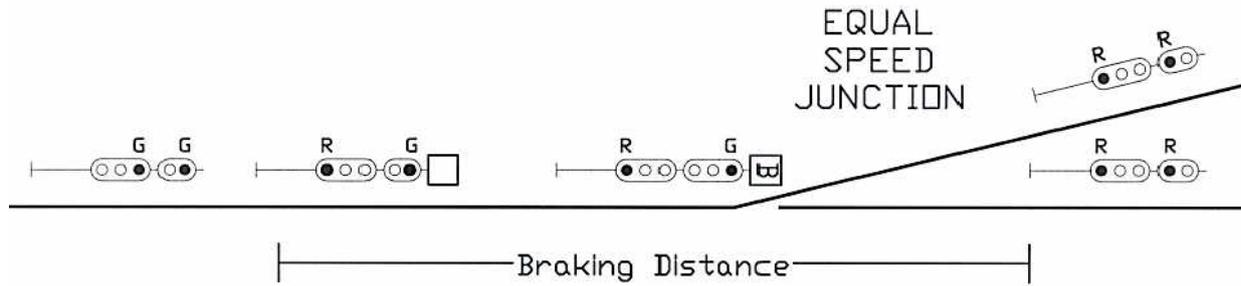
In the above example, a signal at stop has resulted in a medium aspect on the signal before the turnout signal. It would not be possible for the driver to distinguish this arrangement from a standard turnout arrangement.

Hence the driver could approach the junction signal at turnout speed. The consequence is that the train would be travelling too fast to stop at the stop signal.

In this case the driver has been mistakenly led into this situation by the display of the turnout repeater.

The design solution is to inhibit the display of the turnout repeater, and to hold the outer signal at caution.

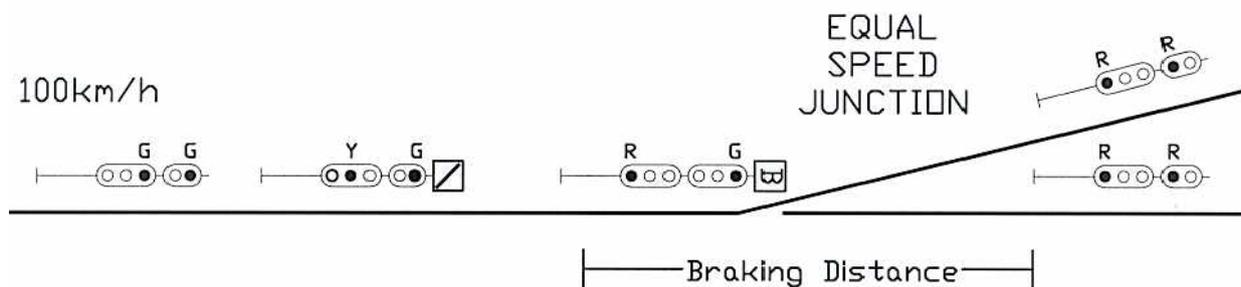
Hence the aspect sequence would be:



The outcomes of this arrangement is that:

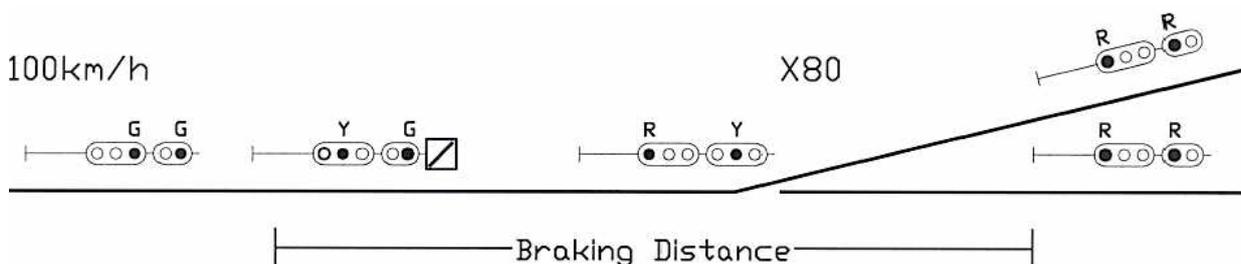
- Drivers approach with the expectation of the junction signal being at stop
- System headway is degraded
- No pre-warning of the turnout route to provide driver of route information is given
- Displaying a turnout repeater in conjunction with a caution aspect, conveys a contradictory dual meaning ie, next signal at turnout as well as stop and is therefor not permissible.

Note that if there is braking distance at turnout/line speed the following aspect sequence is then acceptable.



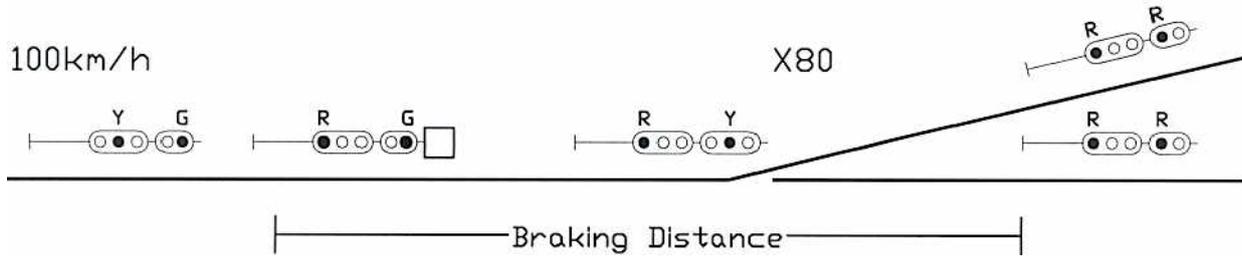
5.2 Turnouts with Speed Differentials

In turnouts where a lower speed applies to the turnout route there is a risk of a train travelling too fast for the braking distance provided.



This is the result of a driver proceeding at turnout speed due to the display of the turnout repeater.

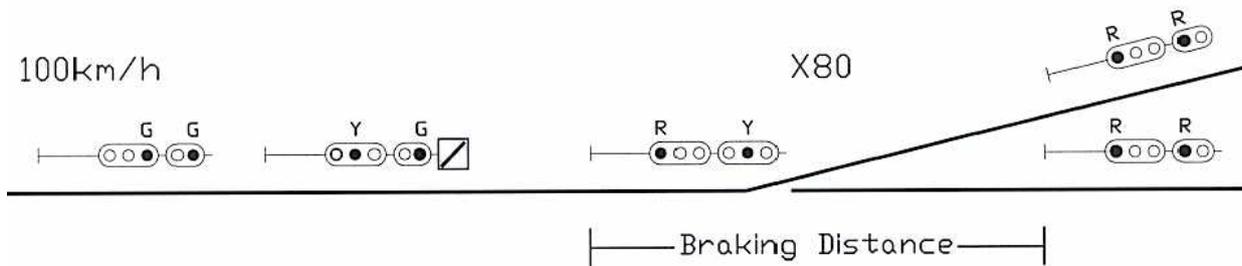
The design solution to this is to reduce the aspects on approach.



The outcomes of this arrangement is that:

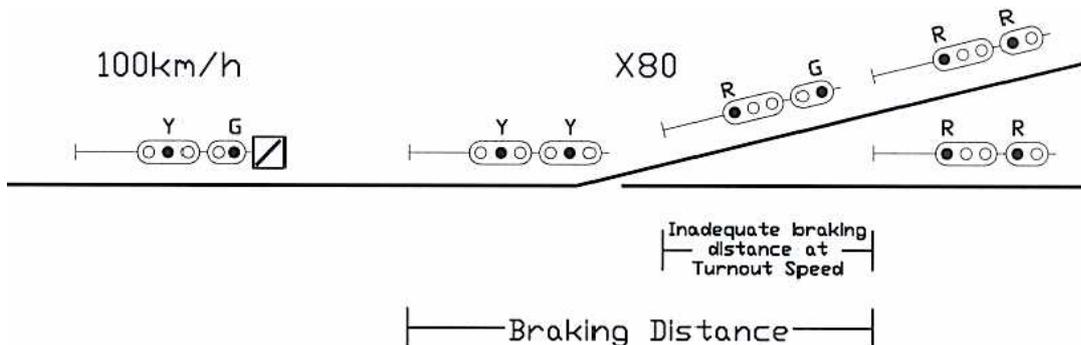
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Note that if there is braking distance at turnout/line speed the following aspect sequence is then acceptable.

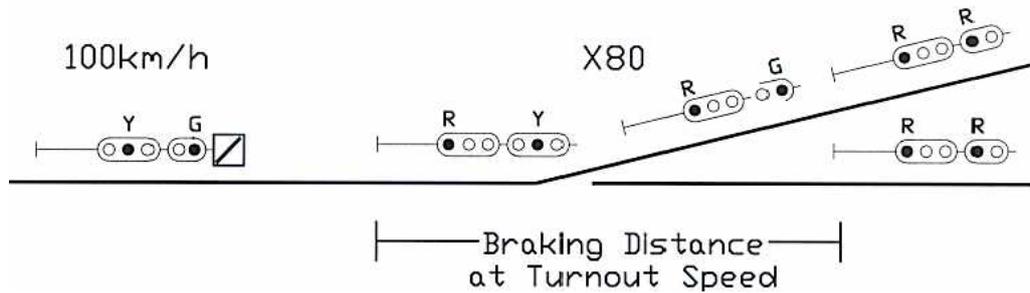


5.3 Inadequate Braking Distances Beyond Junctions

In some cases the inadequate braking distance is between two signals after the turnout signal.



The design solution is as follows:



As the braking distance is adequate (in this example) from the turnout signal, then restricting this aspect to caution turnout provides a suitable solution.

Note that when the braking distance commences at the turnout signal, the indications approaching the turnout still provide the driver with the route information through the turnout repeater.

6 CONCLUSION

The above examples provide guidance on dealing with braking distance issues through turnouts. The signalling is providing two pieces of information to drivers at turnouts, one being the presence of the turnout, the other being the location of stop signal ahead.

There are cases where this information cannot be conveyed to the driver clearly and this paper describes the arrangements that provide a safe situation.

Designers need to be aware of these issues and recognise deficiencies in driver information that different track configurations may present.