SIGNALLING CODE OF PRACTICE
AN AUSTRALIAN PERSPECTIVE

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SUMMARY

The railways in Australia developed on a state basis before federation. Significant differences including gauge and engineering practices abounded in the early days and have continued unabated until the start of this century. With the development of national train operators and infrastructure owners crossing state borders, there is an opportunity for common engineering practices and standards. We has already seen the development of a National Code of Practice (NCOP) for Operations and more recently a Track & Civil NCOP has been developed and is gaining acceptance in multiple states in southern Australia.

The paper examines the issues, opportunities and threats to the development of a Signalling Code of Practice.

1 INTRODUCTION

Since the earliest days railways have adopted standard practices for their operations and engineering divisions. I.K. Brunel of Great Western Railway fame established many standard engineering practices and designs. Followers of British railway history will also note that there were many standard designs for structures, signalling and other railway engineering. This practice was also adopted by the Australian colonial railways as they expanded at the end of the nineteenth century. The limitation was that they were done within the organisation and were well supported by the internal railway workshops and railway construction groups.

The past 25 years has seen the demise of the once great railway workshops and provision of equipment and new works and services by organisations that supply to the national and international markets. The recent trends in globalisation has seen many products for the Australian and Asian markets sourced from multinational companies who design and produce for the world markets.

The differences between the existing standards of the various Australian railway infrastructure organisations often work against an international supplier adapting a new product for the Australian market. An improvement in the level of commonality through the adoption of a Signalling Code of Practice may make the task economic and realisable. It would also provide an avenue for the infrastructure organisations to look more internationally when developing Code of Practice requirements for new technology.

A Code of Practice (COP) is a form of a standard covering many aspects of the signalling technical scope. One argument against a COP or standard is that it favours the existing technology and thus discourages innovation and new ideas. It may also attempt to make one size fits all and not adequately reflect local or specific requirements.

On the advantage side the COP and standards provide the input and considered design of many people at no additional cost. For any given COP item it allows for a deeper level of input and hence a wider range of support information to be readily available. This is also often available before a project starts and not months after it has finished. It permits a whole range of projects and people to apply well researched solutions and standards, when otherwise this may not have been possible.

With regard to innovation, it would not make economic sense to pursue the development of new ideas when there are existing solutions to the problem. The money thus saved, allows for the funds, resources and time to be focused on issues that are not covered by the existing COP or standards. It also encourages the stepwise enhancement to the standards as the needs or technology developments dictate.

If the COP is drafted at the correct level of detail it will also not discourage the incremental development of technology within the nominated framework. It can provide flexibility to tailor design outcomes for specific local requirements.

2 AS4292 RAILWAY SAFETY REQUIREMENTS

2.1 AS4292.1 General Requirements

The current Australian Standard has the objective:

> *"…to provide the railway industry with a set of railway safety requirements which can be incorporated into management systems to adequately control risk by adherence to the safety principles… ".*

It essentially provides a common framework for railway organisations to define how they go about their business while ensuring the safety outcome at all times. The common framework enhances the ability of the Rail Regulators and others to ascertain that the objective of safe operation is being attained.

2.2 AS4292.4 Signalling & Telecommunications Requirements

The standard for Signalling and Telecommunications Systems and Equipment covers: technical requirements for systems safety and requirements for interface and compatibility between functional areas. In particular it covers Risk Analysis, Interface Coordination, Design of Systems, Construction and Implementation, Commissioning and In-service Maintenance. It covers the range of issues to be covered by an Organisation's Practices, Procedures and Standards. It does not nominate how to deal with these.

2.3 Structure For Code Of Practice

The proposed structure would have the AS4292 as the top level of a three tier structure. The COP would cover the Principles, Processes and Common Standards. Individual Organisations would draft more detailed standards, Practices/Procedures and specific technical documentation for their specific requirments. Because of technology convergence it is proposed that the COP would cover both Signalling and Telecommunications as for the AS4292.4. In time it could also cover the aspects of Electrical not covered in the Track and Civil COP.

2.4 Other Codes Of Practice And Standards

Internationally the AAR and UIC have developed Standards and Norms for signalling and telecommunications which have widespread acceptance within their jurisdictions. However, these are not drafted to generally form a Code of Practice. The drafting and acceptance of an Australian Signalling & Telecommunications Code of Practice may well achieve commensurate levels of benefit to the Australian rail industry.

The existing Track & Civil National Code of Practice is organised against specific technical content and does not have a coherent hierarchical structure. It covers from low level track components to high level design issues. The proposed Signalling & Telecommunications Code of Practice should have a hierarchical structure with a consistent level and in accordance with the structure in 2.3.

3 STAKEHOLDERS

While technical engineers in signalling and telecommunications are the main users of the proposed Signalling & Telecommunications Code of Practice they are not the only stakeholders. Full consideration of all stakeholder requirements is necessary to ensure that it will meet industry expectations. The stakeholders and a preliminary set of requirements are:

3.1 Public

Public and commercial users of rail services want a timely, economic and safe provision of services.

3.2 General Community

The General Community wants a railway that is environmentally friendly, socially responsible, and safe for all the community including all those who use level crossings and other points of interface with the general community.

3.3 Train Drivers

Train Drivers want a signalling system that has common standards for drivers, is unambiguous, is flexible in use, provides services even during failure modes and is well documented.

3.4 Signallers And Controllers

Signallers and Controllers want a system that is easy to use and provides performance to cover shortcomings in trains or other infrastructure. It should also be unambiguous, flexible and as common as the range of different situations will permit. It should be readily useable without imposing stress on the signallers/controllers.

3.5 Train Operators

Train operators want a signalling system that is reliable, does not impose unnecessary demands on trainbourne infrastructure, is compatible across a wide range of jurisdictions and will deliver economic train paths. It should also provide recoverability in the event of other failures or incidents.

3.6 Rail Regulators

Rail Regulators want signalling systems that minimise risk and have performance and failure modes that can be readily ascertained and evaluated. They recognise that the more different systems and permutations that exist, the more difficult is the task to evaluate risks and the resources are spread more thinly to do the tasks. Diversity also introduces more interfaces and increases the opportunity for incompatibility.

3.7 Railway Signalling Supply Industry

The Railway Signalling Supply Industry wants commonality, so that it can achieve economies of scale and can invest development resources where there is a reasonable rate of return. Common standard also help to lower barriers to entry to markets and permit supportability of products for longer terms.

3.8 Infrastructure Owners

Finally the Infrastructure Owner wants economic delivery, operation and maintenance of the infrastructure within the safety objectives. They also want ready modification of equipment during its lifecycle and the decommissioning and upgrading of the system at the end of its lifecycle.

4 CONTENT FOR CODE OF PRACTICE

It is envisaged that the Code of Practice would contain the following major items: Principles for Design; Operation Performance Requirements; Interfaces; Design Standards; Construction Practices; Equipment Standards.

4.1 Principles For Design

This issue is often confused with mandating either Route Signalling or Speed Signalling. In fact there are other types of signalling systems including: token working, train order working, cab signalling and in the future communication based signalling systems that can all happily coexist with the above. For the present each is considered a valid signalling system that can effectively and safely support train operations. Behind these signalling systems are many Design Principles which can share commonality as follows. Requirements for overlaps and the relationship with train braking performance can be defined independent of and applicable to each of the signalling systems. Signalling locking principles covering route locking, approach locking, point locking, track locking, and flank protection can be defined in a common standard to meet many signalling system requirements.

With the advent of more technically complex operator interfaces via computer screens, principles for common levels of information will benefit in assessment of the human factors risks for new systems. There is plenty of opportunity to the principles for operator interfaces without restricting the technical solutions.

4.2 Operation Performance Requirements

With older style relay interlockings, technology performance was provided by discreet components often in a distributed configuration in what is generally a massive parallel processing machine. With computer based systems none of the above benefits apply. We have to learn how to specify systems for processing (for signaller and train density requirements), reliability of centralised systems and redundant networks to achieve the required outcomes. These performance requirements are common to many types of signalling systems and can be specified at different levels to match train density and performance requirements. The operational failure modes are also important to full systems safety. These requirements should be defined in the COP so that can be readily applied to many types of signalling systems.

4.3 Interfaces

Within Signalling and Telecommunications there are many different interfaces. The simple interface level covers equipment interface standards including: voltage, current, surge protection levels, and physical interconnection.

System to System interfaces include: signalling to trainborne, operator interface to interlockings, interlocking to interlocking, data communications, ancillary information systems, and interlocking to trackside signalling equipment. A common approach here will aid compatibility, interchangeability and not hinder the development of existing or new systems.

4.4 Design Standards

Circuit design standards including double cutting, back proving and fail safe operation are also common principles across all signalling systems. The different design standards for Route Signalling, speed signalling and new communications based signalling can defined here to minimise the opportunity for minor discrepancies.

Issues such as Aspect and Authority definitions can also be defined here for the different types of signalling systems. These should be defined side by side as in the current TOC manual to allow for future convergence.

4.5 Construction Practices

Many different practices have evolved, sometimes to meet particular circumstances. Many times because different people in different places and time were tasked with defining the practice. With the opening of works construction to outside organisations and mobility of skilled staff, there is a need reduce these differences and adopt common practices incorporating the best knowledge from industry. This would generally be applied for new works and not to enforce retrofitting of legacy equipment and systems.

4.6 Equipment Standards

This is a contentious issue with many. It is also the item where there is more diversity between the various infrastructure owners. As we have seen in the case of British Railway Standards and the AAR equipment standards, it also provides many diverse opportunities for equipment economics gains and supply chain flexibility.

While many equipment items are specific to infrastructure owners, others are common to several and may also be common to other industries. By choosing items such as cables, signals, lightning protection - then early benefits can be gained. A standard COP for cables could be at the generic requirements level, while permitting a variety of configurations to suit individual infrastructure owner requirements.

5 HOW TO DEVELOP

Describing what can be documented and the benefits is the easy part. Drafting the Code documents and getting agreement from interested parties is an order of magnitude more difficult. The Australasian Railway Association (ARA) has a process for developing industry wide Codes and Standards which can be applied in this case. This initially involves the stakeholders in agreeing for the need. This has already been done.

The following steps are then required. The outcomes expected from the process are defined and the resources required to complete the task. When the ARA member organisations agree to these and provide funding or resources in kind, then the implementation can begin.

At this stage the task is handed to the ARA subsidiary – the Code Management Company (CMC) which manages the production of the defined outcomes. At present the CMC is using an Excel Spreadsheet to document the drafting of the new Rollingstock Code of Practice. This permits the ready identification of all content of the code, references for requirements traceability, other comments, change notations and appending of comments by reviewers. This format would be useful for the Signalling & Telecommunications Code of Practice.

6 WHERE TO START

As with all difficult tasks, the wide range of the work needs to be structured to deliver the initial and final benefits to the railway community.

The first task would be the Stakeholder Workshops to define the requirements and outcomes from each of their perspectives. Once they are consolidated and agreed the overall structure of the COP needs to be formulated. This will ensure that a consistent hierarchical structure will be used for all parts of the COP.

The development of Principles for Design and Operations Performance Requirements will provide a solid platform for any new technology development within the industry. It will also prevent further divergence on these issues.

7 CONCLUSION

With the railway industry in Australia facing significant challenges to it providing its services and maintaining or increasing its share of the transport task, there is a great need for a Signalling & Telecommunications Code of Practice to help deliver against these challenges. The foreshadowed significant investments in rail infrastructure over the next few years across all of Australia, provide an unprecedented opportunity to undertake the task now and deliver the much needed benefits.

ABBREVIATIONS

AAR Association of American Railroads

ARA Australasian Railway Association

AS4292.1 Australian Standard Railway Safety Requirements – General Requirements

AS4292.4 Australian Standard Railway Safety Requirements – Signalling & Telecommunications Requirements

CMC Code Management Company

COP Code of Practice

TOC Train Operating Conditions (Manual)

UIC International Union of Railways