Rail Control Systems

Overview

Attachment 1 provides a report from the CE of KiwiRail on the recommended structure for service delivery and resilience regarding centralised train control

Recommendations

It is recommended that the Board:

    i).   Receive the report

Attachment

Attachment 1 - KiwiRail CE Report re Centralised Train Control

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RECOMMENDED and APPROVED FOR SUBMISSION by	David Warburton **Chief Executive**	

Train Control: Recommended Structure for Service Delivery & Resilience

Report from KiwiRail to Auckland Transport

December 2012

Executive Summary

KiwiRail (KRG) was tasked by Auckland Transport (AT) with identifying a practical and affordable path that would give all stakeholders confidence that their interests can be further protected in the event of disruption to the national train control centre (NTCC).

As part of that investigation KRG was required to consider whether a full time staffed facility in the Auckland Metro Area would offer the greatest benefit.

Currently all control for Auckland other than Pukekohe signal box is run from NTCC.

The approach KRG recommends contains the following elements

1. In the context of all the risks faced by the train control system in NZ the overall rail industry and AT specifically are best served by retaining the benefit and operating risk mitigation associated with a centralized control model – which will ultimately roll in all signal boxes.

   (but to better mitigate the particular risks that centralization creates)

2. More of current train control back-of-house services should have their back-up (or have their primary servers) at a different (Wellington) location to deal with potential site specific disruptions (fire/water damage) and that remote location should allow for immediate relocation of some controllers to deal with the impact of an event affecting NTCC (4-6 desks).

3. An un-staffed standby facility should be constructed at a mutually agreed site in the Auckland Area, which in the event of a catastrophic event in Wellington can be used for national control services. The rights the parties have to use of the new capacity created by the back-up facilities will be determined by the funding contribution; (which is the Common Access Terms model).

The Common Access Terms provides a framework for delivering this outcome, and KRG is prepared to take on the role of Proposer under that agreement to drive consultation to a point where all parties understand and accept the risks they are prepared to accept and pay for.

We would see the pricing aspects of this being determined through the access charge discussion during 2013 coming into effect year commencing 1 July 2014.

1.0 Reason for the Current Centralised Organisation

Train Control regulates track access for workers and train running for operators. It uses varying systems (such as signalling, radio, warrants) to manage these activities. However compared to systems serving denser networks world-wide, the NZ system has a high procedural component and is highly reliant on people rather than just process automation.

New Zealand's total rail operation is also small by international comparison; for example the Melbourne Metro operation employs over 100 controllers for just its urban network.

Centralisation began with seven regional train control offices consolidated to Wellington between 1996 and 1998. Staff numbers at the time were reduced from ~40 to 28 using 9 operator desks. Since 1998, the NTCC has managed network access and control services for New Zealand.

To accommodate current and reasonably foreseeable network activity, including the Auckland and Wellington metro areas, the NTCC now utilises 14 operator desks and has an establishment of 46 train control staff under the direct supervision of a network control manager on duty 24/7 days.
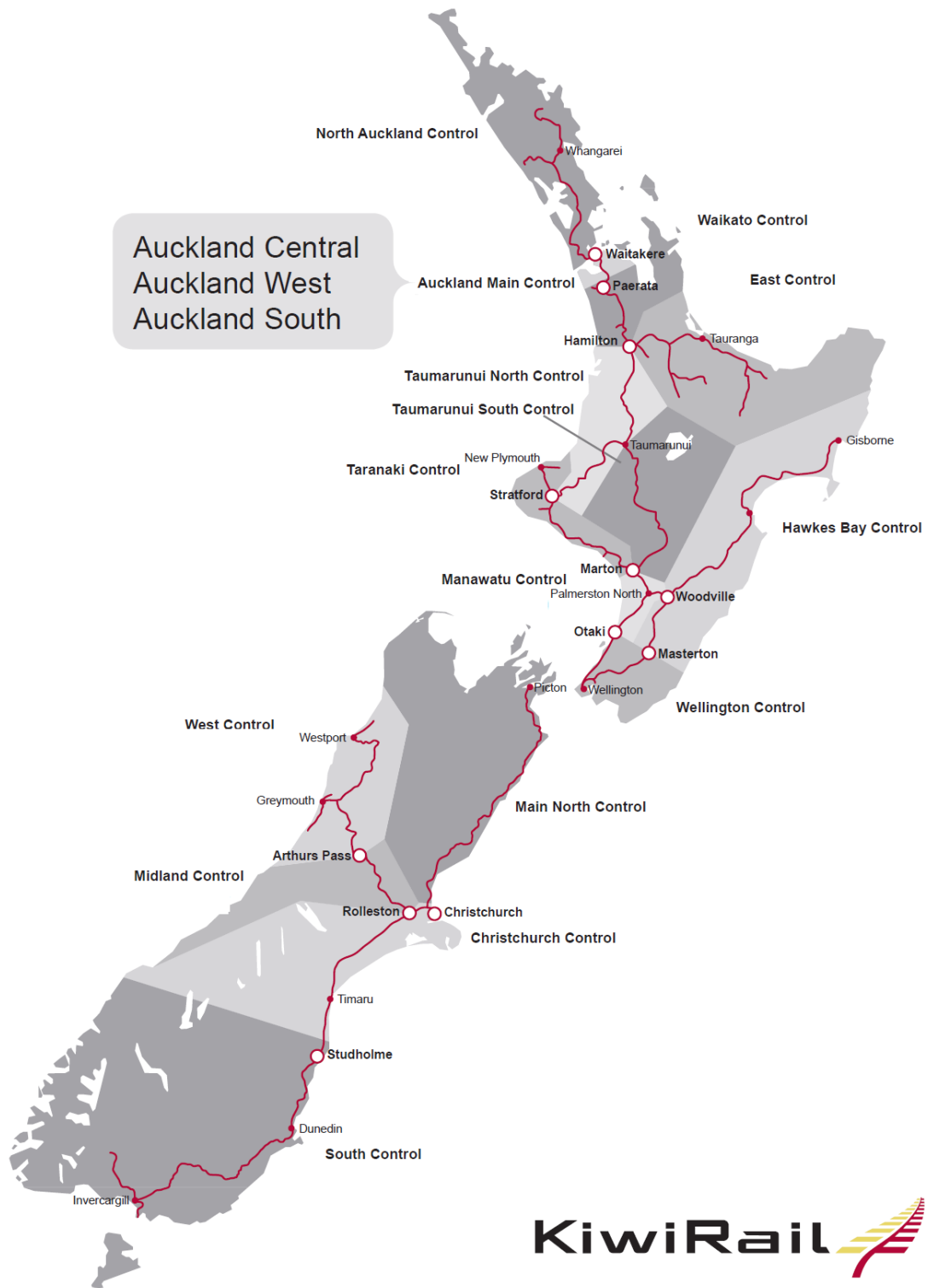
To manage costs, the control zones (see drawing next page) are arranged so that the span of control is increased when traffic drops at night and weekends which means we can come down to as few as 3 controllers on duty at one time. The centre is directly supported by 4 network control managers, 11 Traction Control/Operations Support staff and 8 access planners.

While Train Control uses a number of technical systems (Signalling, radio communications, telephones etc), the key resource is the people that understand and apply the myriad of control processes.

Centralisation was the only model that could create a sustainable staff pool that enabled the greatest flexibility and utilisation opportunity.

As technology develops KRG has provided connectivity to the customer in real time by creating a "virtual shared environment" by using video conference, voice conference, and real-time broadcast of train location into our customer's service centres

Train Control Area Map:

Auckland Central
Auckland West
Auckland South

North Auckland Control
Waikato Control
East Control
Auckland Main Control
Taumarunui North Control
Taumarunui South Control
Taranaki Control
Hawkes Bay Control
Manawatu Control
Wellington Control
West Control
Main North Control
Midland Control
Christchurch Control
South Control

Whangarei
Waitakere
Paerata
Tauranga
Hamilton
New Plymouth
Taumarunui
Gisborne
Stratford
Marton
Palmerston North
Woodville
Otaki
Masterton
Picton
Wellington
Westport
Greymouth
Arthurs Pass
Rolleston
Christchurch
Timaru
Studholme
Dunedin
Invercargill

KiwiRail

2.0 Why did we continue with the centralised control centre when Auckland signal and control systems were updated?

During 2008 and 2009 KiwiRail considered options for handling the centralisation of four fulltime staffed local signal boxes in greater Auckland and consulted with ARTA on these options.

These signal box closures were an essential component of the complete replacement for all signalling in the Auckland Metro area in order to immunise the system for electrification.

The bulk of Auckland Train Control was already run from NTCC in Wellington so the decision at the time was whether to

- move patches of local signal control and integrate into the established Auckland network control centre, or
- move the full network control process to Auckland.

Three options were considered and their pros and cons at the time were as follows:

Option A - Centralise all operations to the NTCC Wellington:

This involved all remaining local Auckland signaling transferred to the NTCC to join with the existing remote Auckland signaling and Auckland Train Control that was already in NTCC. This would add ~8 new staff to the NTCC to join an existing and established team of 50 (Management and NTCC operations staff).

> - Most efficient use of operations staff and management staff.
> - Greater daily contingency to cover staff absence/incidents.
> - Easiest to provide consistent management and standards at a single site.
> - Equipment provided in Britomart to allow for local control of Auckland metro signaling in a DR situation but with about 6hr outage risk while trained staff are relocated to Auckland.
> - Retains access provider independence.
> - Uses technology to share information and collaborate with operators.

Option B – Create a new site in Auckland for Auckland Metro control

This involved all Auckland metro signaling, train control and Metro operations centralised to a new building/location in Auckland requiring ~19 new staff with a reduction of ~2 staff from the NTCC. (The Britomart Transport Centre was not large enough to properly accommodate the equipment and facilities needed for an Auckland Train Control operation so a new site was required).

- Less efficient use of operations staff and management staff.
- More difficult to provide consistent management and standards.
- NTCC would be equipped to control Auckland metro in a DR situation but with some limitations.
- Beneficial in Auckland metro passenger operators view as they could have face to face interaction with train control staff, but access provider independence potentially reduced.

Option C – Create a new site in Auckland with 50/50 Split of national network control services

This involved a new control centre established in Auckland for the upper North Island, and the existing Wellington control centre down-sized to cover lower North Island and South Island only. Significant restructure of staff with ~40% of positions needing to be re-established in Auckland. New building/location required in Auckland.
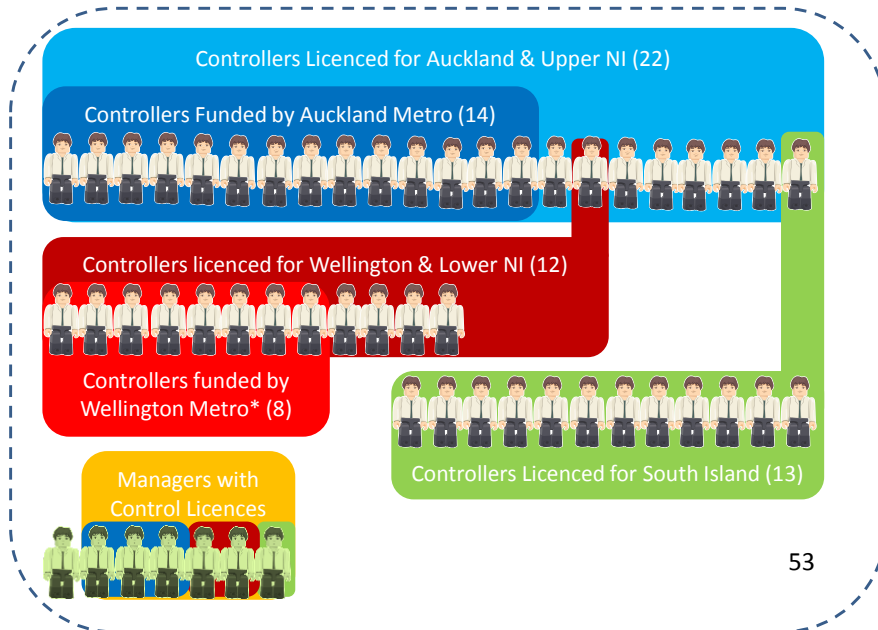
- Less efficient use of operations staff and management staff.
- More difficult to provide consistent management and standards.
- High cost and high industrial transition risks.
- Both sites could be equipped to control nationally in a DR situation, but ~6hr outage risk while trained staff are relocated.

Option A, Centralisation to the NTCC, was selected by KiwiRail as being the optimum set-up for efficiency and safety.

Further centralisation work is planned for 2013/14 when we close 3 Wellington Metro local signal boxes and amalgamate their work within the NTCC.

The diagrams below demonstrate the staff ratios and cross-skilling currently available. The key advantage of a single centralised model is the ability to make more effective use of the 53 licensed employees and manage hours per reports from Transport Accident Investigation Commission (TAIC).

**Staff Establishment and Competency Diagram
for Single Centralised Train Control Site**

Controllers Licenced for Auckland & Upper NI (22)

Controllers Funded by Auckland Metro (14)

Controllers licenced for Wellington & Lower NI (12)

Controllers funded by Wellington Metro* (8)

Managers with Control Licences

Controllers Licenced for South Island (13)

53

* Note does not include 8 FTE local signal box controllers

The notation about funding refers to the fact that network control costs are spread on a per controller basis between Auckland metro area, Wellington Metro area and the national network. Within each of the metro areas there is a further apportionment of costs between freight and metro users based on the number of train movements.

Training, licensing and hours of work rules place a number of restrictions on how the workforce can be used. With a combined team, the current structure provides the greatest cross skilling opportunity available.

Under the current regime Train Controllers are licenced to control on average 5 of the 18 specific geographic areas of track under KiwiRail's rail safety licence, regulated by NZTA. The safety case prescribes that Controllers must work a minimum period of 6 months continuously a geographic area before they are able to be trained and licenced for another – Therefore achievement of a licence to control 5 areas takes a minimum of 2.5 years. In realty this period is longer considering trainer availability and roster rotation requirements. The smaller the pool of staff, the harder it is to develop cross-training.

3.0 Disaster Recovery under the current centralised model

The NTCC is constructed to be resilient to most probable risks. Key elements are:

- Multi skilled staff to cover sickness/incidents/business and work flow changes
- Multi-path power, data and communication links including use of different main telephone exchange connections
- Interchangeable workstations within office
- Some back-up off-site servers for key applications (more being diversified during 2013/14 and Auckland already hosted in 2 independent sites locally)
- Generator feed for 48 hrs without re-fuel

In November 2011 KRG commissioned an NTCC risk analysis report from Aecom which identified 8 different categories of events being

1. Power failures
2. External and extended building environment failures
3. Voice and data link failures
4. Network Hardware and configuration failures
5. Security breach causing failure
6. Server and workstation failure
7. Personnel absence

Under each of these categories there are a series of events ranging from the trivial – "water spilled on a server rack" through to catastrophic "fire destroying the server room". The impact was measured in terms of immediate effect on safety, service levels and then time to restore.

Consistent with normal risk evaluation practice the events were assessed under likelihood and consequence. The consequence was further disaggregated into effects on Metro, significant Freight lines and lesser freight lines.

The key findings from that analysis is that events are generally low probability and can be better mitigated with a greater degree of physical separation of equipment. However the people related events are worsened by dis-aggregation.

The safety impacts are very small; in the event of failure the lights go red and trains stop.

At the moment in a disaster event that rendered the NTCC physically unusable, the only area that has a secondary control site available is Auckland Metro. No other control areas currently have an alternate operating site.

Overall KRG considers the absence of a separate NTCC back-up site to be an unsustainable level of vulnerability to its business and wants to do more to mitigate this.

The 2010 project to centralise the Auckland Signal Boxes has already provided two hot stand-by control desks for Train Control operations. These two desks are located in the redundant signal box facility at Britomart Transport Centre. The Britomart facility however was not large enough to construct a fully functional facility of 4 control desks, 1 control manager and 1 traction control desk.

For the avoidance of doubt Auckland licensed controllers can today go to locations in Britomart, and Westfield plus the offices in Stanley Street and run the Auckland network. The system supplies in Australia and Spain also have remote diagnostic connections.

At present with the Project running it is relatively straight forward to put a competent person in front of those Auckland based controls. Subject to funding arrangements we intend to keep a level of signals engineering resource permanently in Auckland so this can continue beyond the project end.

4.0 Alternative models

Because of NZ's high reliance on depth of the controller "pool" most of common risks around people and performance that are generally faced by a centralised control centre are not mitigated, and in many cases worsened by having a second centre.

However there is no doubt the resilience of New Zealand's rail network to a catastrophic disaster in Wellington (eg earthquake) or within the Wellington Station (eg fire) will be improved by the construction of an alternate operating train control site capable of running some/all areas. The infrastructure and systems construction cost of a full duplicate facility (with no staff/restructuring or building lease/purchase costs) has not been properly costed, but based on what AEP has cost, is likely be in the range of $3m-$5m
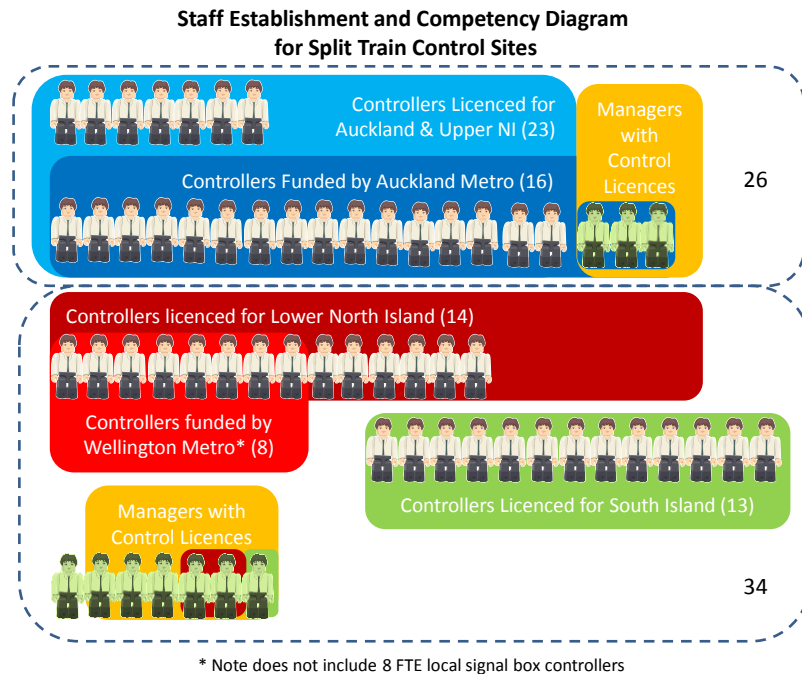
That benefit accrues to all operators; a significant consideration under the contractual access and cost sharing arrangements between KRG and all Operators covered in section 5.0 below.

There are a number of models that can be considered but they can be broadly divided into two generic groups

1. Non-staffed facilities that controllers can be shifted to in an extreme event
2. Permanently staffed facilities which can provide more immediate response – but which would still require some controllers to be shifted to for national coverage

If (1) were to be considered the issue is simply how much capacity do you duplicate; metro areas only, metro and selected routes, everything?

If (2) was to be contemplated the best model would have a structure as depicted in the diagram below. The model is bigger than simply having Auckland metro area but creates an Upper North Island centre and "the Rest of NZ" centre.

Staff Establishment and Competency Diagram for Split Train Control Sites

Controllers Licenced for Auckland & Upper NI (23)

Controllers Funded by Auckland Metro (16)

Managers with Control Licences

26

Controllers licenced for Lower North Island (14)

Controllers funded by Wellington Metro* (8)

Controllers Licenced for South Island (13)

Managers with Control Licences

34

* Note does not include 8 FTE local signal box controllers

Provided there are enough people in each centre trained and "current" to do the other centre's tasks splitting the control staff will mean one Metro network can be immune from the effects of a catastrophic disaster in the other.

This model does mean an increase in operational costs, reduced staff utilisation, increased contingency coverage and moves away from TAIC recommendations relating to avoiding fragmentation.

Notwithstanding that, it could be made to work, but KRG neither recommend not support it at this time.

KRG does believe that a suitable point for revisiting that conclusion will come with the Central Rail Link (CRL) construction. At that point the added complexity, fire and security requirements of an underground system would suggest that benefits of amalgamation of underground activities with train and traction control and train operations might outweigh the risks of dis-aggregation.

For this reason any site identified per recommendations in section 6.0 below should take into consideration the potential for full manning in the future.

5.0 Access Contractual Position

The Access Agreement and Common Access Terms (CAT) signed by KRG and AT provide the contractual framework for this type of change/development to be assessed and funding accountability determined.

CAT clause 10 deals with material changes to infrastructure (such as the construction of a new train control facility).

In brief the framework is as follows

1) The person wanting the change "The Proposer" is responsible for managing the consultation with affected parties including of course other Operators
2) The Proposer must bear all costs but
   a. May negotiate with other parties to share the costs of making and maintaining the proposed change
   b. Each party must consider and respond fairly to the proposal to share costs
3) The work needs the Access Provider approval (not unreasonably refused)
4) The Access Provider has the right to carry out the works itself or set such terms as the AP reasonably requires the Operator to do.

The whole objective of the clause was to ensure that no single Operator or the Access Provider can make changes that might benefit them at the expense of other operators.

In the case of train control, taking a pure commercial/railway benefit perspective, the clause should mean there is a real incentive to come to a solution that all parties (KRF, GWRC and AT) see as adding value. KiwiRail as Access Provider becomes the Proposer and delivers on the obligations and gets funding from AT/GWRC/KiwiRail the Operator for elements of benefits.

If an operator proposed to fund a direct change – then the range of costs it as the proposer would incur would be-

- All physical costs of construction
- All costs of recruitment and training
- 2 additional controllers and 3 additional management positions
- All costs of Auckland traction control
- The additional cost of traction control in Wellington/NIMT brought about by duplication
- All additional costs associated with the dual centres

The CAT does provide for the person who funds the works to get priority from the additional capacity created by the works (provided other operators are not prevented from exercising their rights).

In the case of train control however, there is no additional capacity created. The same capacity is delivered from a different location.

6.0 Conclusion

KRG believes that while the overall train control system continues to remain heavily reliant on people and process there is an industry-wide solution that makes sense for all parties comprising the following elements

1. The industry retains the benefit and operating risk mitigation of the centralisation model – which will ultimately roll in all signal boxes.

   (but to mitigate the residual centralization risks)

2. More of current train control back-of-house services should have their back-up (or have their primary servers) at a different (Wellington) location to deal with potential site specific disruptions.

3. That remote location should allow for immediate relocation of some controllers to deal with the impact of an event affecting NTCC (4-6 desks).

4. An un-staffed standby facility should be constructed at a mutually agreed site in the Auckland Area, which in the event of a catastrophic event in Wellington can be used for national control services. The rights the parties have to use of the new capacity created by the back-up facilities will be determined by the funding contributions (eg the CAT model).

The Common Access Terms provides a framework for delivering this outcome, and KRG is prepared to take on the role of Proposer under that agreement to drive consultation to a point where all parties understand and accept the risks they are prepared to accept and pay for.

We would see the pricing aspects of this being determined through the access charge discussion during 2013 coming into effect year commencing 1 July 2014.