Before a Board of Inquiry

Under	the Resource Management Act 1991
In the matter of	Notices of requirement for designations and resource consent applications for the Transmission Gully Proposal
Between	**NZ Transport Agency**
	Requiring Authority and Applicant
And	**Porirua City Council**
	Local Authority and Applicant
And	**Transpower New Zealand Limited**
	Applicant

Statement of evidence of Jonathan Francis Mason for Transpower New Zealand Limited

18 November 2011

I M Gordon & M J Slyfield
Barristers
Stout Street Chambers
Wellington

Telephone: (04) 472 9026 & 915 9277
Facsimile: (04) 472 9029
PO Box: 117, Wellington 6140
Email: ian.gordon@stoutstreet.co.nz
morgan.slyfield@stoutstreet.co.nz

mjs0047

Qualifications and Experience

1. My full name is Jonathan Francis Mason. I am employed as a Projects Manager by Transpower New Zealand Limited ("Transpower").

2. I manage Transmission line refurbishment, upgrade and new build projects mostly in the lower North Island of New Zealand.

3. I completed a New Zealand Certificate in Civil Engineering while training as an Engineering Officer Cadet for the then New Zealand Ministry of Energy commencing in 1981. I have a diploma in project management and completed Project Management Professional Training. I am conversant with both the design and construction of transmission lines.

4. I have 30 years experience in the construction industry, 27 of which are directly related to transmission line construction and maintenance. I have been involved in a major transmission construction namely the Huntly to Stratford 220kV line where construction techniques extensively utilised helicopters due to the nature of the terrain. I have also spent two years in Papua New Guinea on Transmission line maintenance.

5. My current duties involve project management of lower North Island National Grid projects namely transmission line upgrade projects and tower and pole line conductor replacement. I am involved with checking projects at the investigation stage to ensure that the appropriate design solutions have been explored and the works will be able to be built and maintained. My key role is to take projects from the concept stage to completion. This involves getting detailed design completed, engaging contractors and ensuring the works are carried out to the requirements of the contract. My other duties include safety procedure development, mentoring other project managers, approving contractor environmental and construction management plans.

Scope of Evidence

6. The NZ Transport Agency is proposing to construct, operate and maintain a 27km section of state highway from Linden to MacKays Crossing. Parts of Transpower's Paekakariki to Takapu Road (PKK-TKR A) 110kV electricity transmission line between MacKays Crossing and the Pautahanui Substation ("the Line") need to be relocated to enable the state highway project to proceed. Transpower is therefore applying for resource consent for the necessary relocations of the relevant parts of the Line ("the Line Relocation Works").

7. Projects in the lower North Island are typically run from Transpower's Palmerston North Office. Projects of a transmission line nature are allocated to a project manager at the investigation and design phase so potential construction and maintenance issues can be resolved before works commence. This was the case with this project. If this project is approved for construction my ongoing role will be to manage the build process.

8. I am familiar with the Line. I was the Project Manager for the reconductoring of the Line in 2002. I have read and contributed to the application documents.

9. In this brief of evidence I:

    (a) Provide an overview of the construction processes for the Line Relocation Works and the importance of maintaining power supply; and

    (b) Describe the measures that will be used to mitigate potential effects from those construction activities, and confirm the workability of those measures from a construction management perspective.

10. I have read the Code of Conduct for Expert Witnesses as contained in the Environment Court Practice Note 2011, and I agree to comply with it as if this Inquiry were before the Environment Court. My qualifications as an expert are set out above. I confirm that the issues addressed in this brief of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Executive Summary

11. The proposed deviation of the Paekakariki to Takapu Road (PKK-TKR A) 110kV electricity transmission line between MacKays Crossing and the Pautahanui Substation will involve the construction of 6 new sections of transmission line. Those new sections involve construction of 24 new towers, replacing 25 of the existing towers. The new tower types will be similar in appearance and any new conductor used will be the same as existing type of conductor.

12. Access works will be developed as part of the detailed design process with all constraints of each site considered before any earthworks commence. Consultation with the landowners to develop access agreements will be carried out prior to works commencing.

13. The foundation designs will be standard for the tower types proposed, with some deviation dependent on access constraints and the type of soils encountered.

14. Tower assembly and erection and conductor installation methods to be used on this project will use best practice industry techniques.

15. Similar standards will apply to the dismantling of the redundant tower line sections.

16. The works affect a key operational transmission asset and all works will need to be carried out following careful planning and implementation of comprehensive management systems. This is a minimum requirement to control and mitigate any risk of loss of supply from the construction of the proposed deviations.

17. The measures proposed to manage construction effects are workable and from a project management perspective I anticipate they will be effective.

Construction Overview

18. The Line Relocation Works will involve a series of construction related activities, which are broadly categorised as follows:

- Complete investigation and final design;
- Complete a construction scope of work and programme the sequence of construction events;
- Contract a specialist contractor to install access tracks, and tower foundations, erect towers and undertake final wiring during key outages on the transmission line; and
- Commission the works and reinstate all sites.

19. The management of the detailed design phase becomes the responsibility of the construction project manager along with an appointed Engineering manager. This close supervision will ensure the best solution for each site is achieved. This is important to Transpower for ease of construction and to help minimise ongoing maintenance of the Transmission line.

The Construction Works

Vegetation clearance for towers and access tracks

20. The extent of vegetation removal will not be fully identified until detailed design determines the exact locations of all access tracks and extent of any tower site benching.

21. Vegetation removal will be kept to a minimum and controlled through site survey techniques and visual identification once access routes are finally identified. In steep hill country such as Transmission Gully, vegetation is essential for slope stability and it follows any reinstatement will include the re-establishment of vegetation as soon as possible.

22. In my experience the design principles and proposed conditions of consent that relate to best practice for earthworks design and vegetation clearance, as described in the application, are sound and workable.

23. In addition, vegetation removal may be required under and beside the transmission line, or where conductor clearance under conditions causing blowout of the conductor (like high winds) causes the conductor to approach vegetation. This is discussed in the evidence of Ms Helen Yorke. Again this can be determined at the design stage but must also be checked once the line is constructed.

Preparation of access tracks

24. As far as possible existing access tracks will be utilised and new tracks will be formed from these to the proposed new tower sites. The detailed design process, as previously mentioned, will quantify the extent of these access tracks and incorporate the same best practice principles that are described in the application. In my experience on projects of this scale it is normal that a consent process would follow the detailed design of the access tracks.

25. Access tracks will be required initially for the construction of the transmission line and then for the long term maintenance requirements. For this Line new access tracks will be required for the deviated sections and upgrade of some existing access tracks to towers at each end of the deviated sections.

26. Full landowner consultation will be carried out prior to any access construction or upgrade.

27. New access ways need to be formed with a minimum width of approximately 3.5 meters and wider at certain points like corners.

Additionally, the grade will be designed to ensure a safe traverseable access is formed.

28. If an access track cannot be formed because the minimum widths cannot be achieved or the grade is too steep or where geological conditions are present that preclude construction, then alternative construction techniques will be employed, such as helicopter use.

29. During construction, access tracks will be used to convey pile drilling equipment, transport of material (including steel and concrete) and finally an all terrain type crane to erect the tower. Linemen crews will continuously use the tracks to construct the works through to the final wiring stage. Four wheel drive vehicles are required to be used for all construction and maintenance activities.

30. Should helicopter construction be required then alternative foundation designs will be required to allow manual excavation, then all materials are flown in by helicopter. Towers can also be erected by helicopter.

31. The process for construction of an access track is as follows:

- Survey and peg out limit of earthworks and track centreline;
- Fence off any environmentally sensitive areas in close proximity (where necessary);
- Construct sediment controls for fills;
- Earthworks to prepare spoil disposal areas including silt and sediment controls;
- Construct cut-off drains at tops of cuts to intercept clear water – clean water diversions;
- Construct silt fences at the toes of fills;
- Remove topsoil from within the earthworks limits;
- Carry out earthworks;
- Construct side drains, culverts and grit traps;
- Close spoil areas, topsoil and re-grass;
- Construct road and tower pad pavements;
- Topsoil and hydro-seed cut and fill batters; and

- Decommission sediment control measures when the site is stabilised.

32. Access construction across flat areas is more straight forward in that often only topsoil is removed and gravel placed. In many circumstances, especially arable paddocks, the soil is left undisturbed and treated as dry or summer access only. In such case reinstatement comprises resowing grass.

Preparation of tower sites

33. Tower sites in hill country, such as Transmission Gully, are often naturally located on ridges and hillsides, therefore, some platform construction (benching) is required to allow the safe operation of excavation plant machinery used for tower foundations and a crane setup required to erect the tower.

34. It follows that the benching will be carried out on sites where access tracks can be constructed to the site as this will allow for the cranes or machinery at site. Only moderate benching will be required where manual foundation hole excavation is adopted (without vehicular machinery).

35. Construction of benches on sites for the actual tower positioning follows similar design criteria as for access track construction, in that a design process is also required to get the best result. A key constraint is to minimise loss of height from the ridge through the benching process, as this would mean taller towers are required to compensate. An area to locate and safely operate machinery on the site is required.

36. The machinery required on site for tower construction includes a hole boring or drilling rig. The size and type is dependent on the soils expected to be encountered and the size / depth of the excavation. Concrete trucks can usually follow the same access and benching used for other vehicles. Cranes require more room for their outriggers or stabilisers. In addition some lay down area is required to assemble the tower on the ground prior to lifting into position. Lay down areas will be kept to the minimum required and need not to be level.

37. Tower sites on flat terrain present far less constraints for access of heavy plant; however if wet soil conditions are prevalent and winter construction is required then access tracks may need improving with importation of roading material to create a good track surface.

38. The areas required typically for tower sites are described in further detail in the application documents (section 3.5.4).

39. The process for construction of site benches and crane pads is as follows:

- Survey and peg out limit of earthworks;
- Fence off any environmentally sensitive areas in close proximity (where necessary);
- Earthworks to prepare spoil disposal areas including silt and sediment controls;
- Construct cut-off drains at tops of cuts to intercept clear water – clean water diversions;
- Remove topsoil from within the earthworks limits;
- Carry out earthworks;
- Integrate with any side drains, culverts and grit traps made for access tracks;
- Close spoil areas, topsoil and re-grass;
- Topsoil and hydro-seed cut and fill batters;
- Decommission sediment control measures when the site is stabilised; and
- Re-profile site when all works complete and re-grass/vegetate as required.

40. Mitigation of the impacts of benching follow the same principles as access track construction, in that sedimentation runoff control is required and all benching materials are removed from site. The key difference from access track construction is that more extensive reinstatement can be carried out; that is, benches can be reprofiled and given a natural shape as they are unlikely to be reused for all sides of the tower. This may include the return of some spoil previously removed.

Installing foundations

41. The preferred foundation design is a bored concrete pile also known as a cast-in-situ concrete pile. They are preferred as they are the quickest

and therefore the most economic foundation to install. To excavate the pile hole however a drilling rig is required capable of contending with the conditions that soil investigations have disclosed.

42. The alternative is a pad and pedestal type foundation. These foundations are typically not as deep as bored piles, but initially have a wider excavation. They are often adopted where soil conditions prevent deep foundations or the use of manual excavation techniques are required due to limited access.

43. The typical process for the construction of a bored concrete pile foundation involves:

- Excavating the foundation hole;
- Installing the steel reinforcing cage inside the excavation;
- Installing the formwork to shape the top of the foundation pedestal;
- Installing the stub leg to accurate dimensions using support frames;
- Placing mass concrete; and
- After the concrete has sufficiently cured, the temporary framework used to support the stub leg, and the formwork is removed.

44. With all foundation types the above ground pile cap is about the same size and kept to a minimum so as the overall tower footprint is also minimised.

Photo 1: typical completed tower foundation

Erecting towers

45. Tower erection has three distinct operations; firstly, the tower steel is delivered to laydown / assembly areas and unloaded. Secondly, the sub-assemblies are put together ready for erection. If a laydown area is confined then this may be done incrementally as the tower is built. Finally, full erection of the tower occurs rapidly once all sections are assembled.

46. There are several alternative methods available to erect a tower. Using a crane is the preferred method as they provide a stable and efficient means of raising and holding sections while they are bolted together. Helicopters are also commonly used especially where access to site is constrained. Helicopter use requires assembly of tower sections at another site suitable for assembly of all the sections and for ease of flying the sections to the tower site.

Photo 2: tower assembly and erection using crane techniques

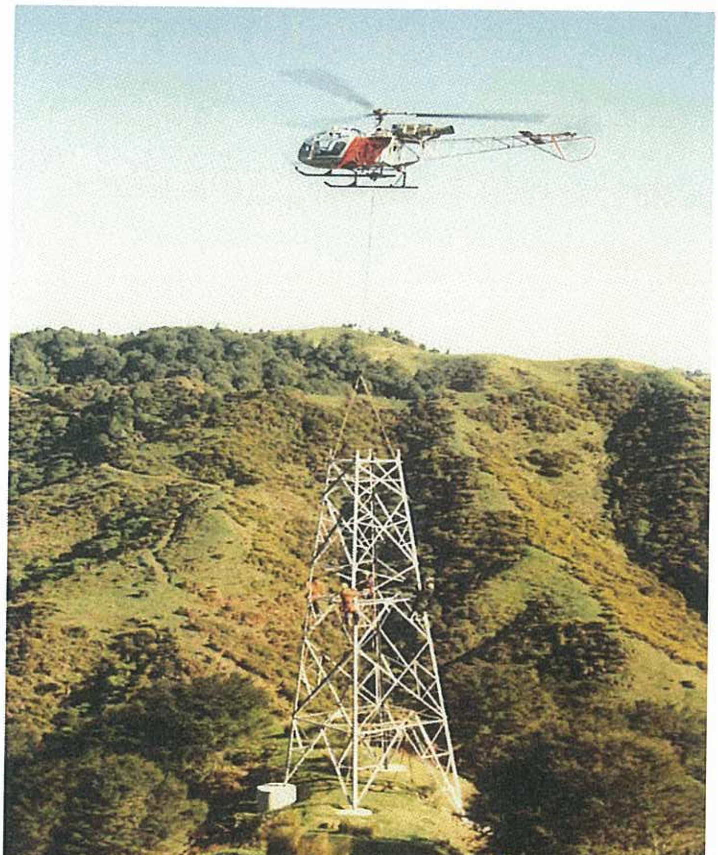

Photo 3: tower erection using helicopter

47. Another technique utilises what is known in the industry as a Gin Pole (or floating derrick) in combination with a portable winch. This technique has been used extensively and utilises the actual tower to support the gin pole. It is particularly suited to sites with restricted access to raise and install sections of steelwork progressively onto the tower.

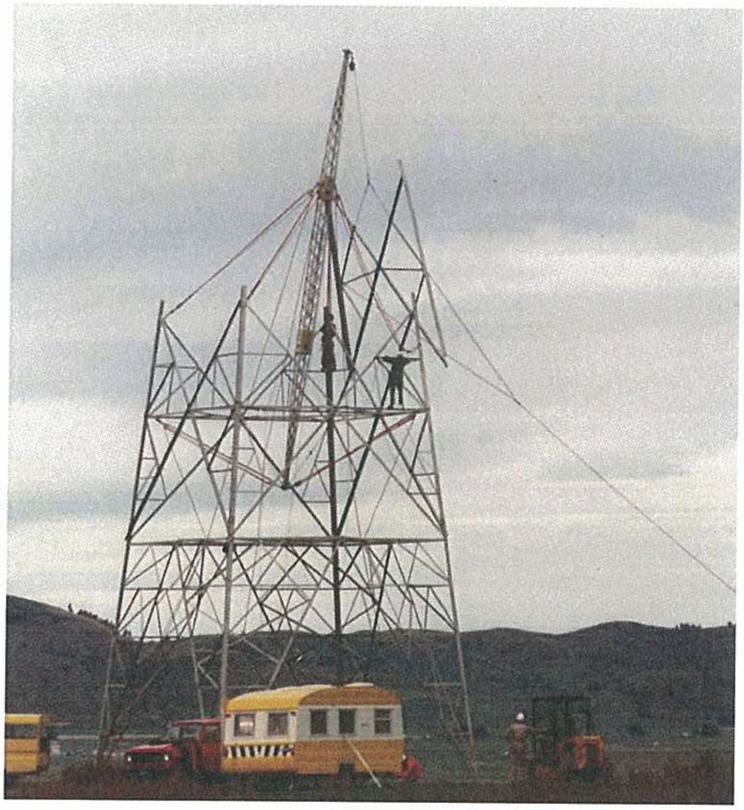

Photo 4: Gin pole in use

Temporary line deviation

48. At this stage the use of a temporary line deviations to aid the overall construction has not been considered. Temporary line deviations are sometimes used so that a line can continue to operate while new sections are under construction. A temporary line deviation allows the power to be re-routed around the area of the line under construction. At this stage it is anticipated that the ability to move one circuit at a time onto the new section of line will avoid the need for temporary deviations.

49. If it becomes apparent during detailed design that temporary line deviations are required, then the construction of such deviations would

follow the same principles for mitigation as the permanent line, albeit for a shorter period.

Conductor stringing

50. Conductor stringing will commence as soon as a complete section of towers are prepared. Conductor stringing requires a greater number of linemen resource and specialised heavy plant. The work is planned as a continuous operation as the conductor needs to be secured once placed on the towers. Typically the run length is determined by the constraints of the line and areas suitable to setup heavy machinery. The length of conductor supplied on each drum is also a factor. Typically 3-4 kilometres are pulled out at once but up to 6 kilometres can be achieved. The deviations on this project will mostly be under 4kms in each area.

51. The tension method of conductor installation is preferred as this keeps the conductor off the ground and eliminates the risk of damage to the conductor. To enable tension stringing a pilot line is first pulled out and fitted into running blocks (pulleys) at each tower, this is usually carried out by helicopter. The pilot line is then threaded into specialist winching plant and connected to the conductor. The conductor is then slowly winched into position. Once the conductor has been placed in its final design position it is clamped in place at the bottom of each insulator on the towers.

52. Conductor stringing on this line is further complicated by having to eventually connect it in to the existing line. To do this a power shutdown is required on the existing line and only one circuit (one circuit is a set of 3 conductors in a vertical configuration in this case) can be completed at a time to ensure continuous power supply. The section of newly constructed line is prepared and held on anchors. Once the outage commences the new section is connected to the adjacent existing section of line. The redundant section of the conductor is then dismantled from the section avoided by the deviation.

Photo 5: Conductors anchored to the ground at the end of wiring run

53. There is need for additional plant and anchor positions for the stringing of each section of conductor. This requires additional land to be occupied for up to 3 week periods, or longer, depending on the length of the deviation. There can be some flexibility as to exact setup points, but with deviation work the options are limited due to the need to connect to the existing line. This can lead to additional access and benching work to achieve these positions. Where this is necessary all normal controls are put in place as with any earthworks.

Existing tower and partial foundation removal

54. Once the line is commissioned onto the new deviated sections, the redundant sections can be dismantled.

55. The first stage of dismantling is to remove the conductor from the line. This can be carried out in two ways, either by lowering the conductor to the ground and pulling in on winches or by tension destringing - effectively the reverse of constructing the new lines.

56. Removing the conductor by lowering to the ground can only proceed when terrain conditions permit. It is unlikely to be achievable where there are roads, buildings or any other operations that would be affected by the works. This is a quick method but does rely on pulling the

conductor in by winch across the ground. From experience this causes little or no damage, except farm fencing needs to be protected. All conductor is removed from the site and scrapped once gathered in.

57. The other method is to tension destring and this requires the same plant as for constructing a new section of line. In this case the operation is reversed and the line is left with a nylon pilot line in place on the towers. This must then be removed and can be done by either by lowering to the ground and rolling up, or winching back utilising a helicopter at the tail section to provide tension as it is reeled in.

58. Once the conductor is removed it is possible to dismantle and remove the towers. Again the choice of method for this work is similar to the initial construction. Two constraints determine how the tower will be removed, firstly, the access available to the site and secondly, the need to keep the towers for reuse. It is not common to keep these towers for reuse therefore the method of recovery chosen is the least cost.

59. If the towers are to be kept then the method of dismantle would be again by crane if the access and site was suitable or alternatively by helicopter if the access was constrained. It is not normally cost efficient to upgrade the access just to recover small amounts of steel.

60. If the towers are deemed scrap value only then the demolition can be done by cutting 2 legs at the base of the tower and then winching the tower over. The steel can then be cut up and disposed of for scrap. Access ways do not need to be upgraded as machinery with self laying tracks (ie tracked digger) can be utilised.

61. Once the tower steel is removed the old tower foundation must be demolished also. This work requires all old foundation material to be cut back to at least 600mm below normal ground level. A digger is required for this work and the old steel tower legs are then cut off and removed for scrap. The work is more difficult if there is a concrete pile cap, where a digger with an pneumatic breaker would need to be utilised to break up the concrete. This concrete can be either buried on site or removed to an approved dump site.

62. Once all materials are removed the site can be reinstated. Re-contouring of the site followed by re-grassing and vegetation planting is done in consultation with the landowner so there is agreement as to the final appearance of the site.

Site reinstatement

63. Although reinstatement is carried out incrementally as the work progresses, once all construction traffic finally ceases a final check of all sites will be done and any further reinstatement or repairs, such as where regrassing may have not taken is carried out.

64. Transpower has ongoing maintenance regimes for all its transmission lines, which includes access and site stability. An acceptance signoff with the landowner will form part of the final check.

65. Any office and laydown areas will be reinstated to a condition as good as prior to works commencing.

Construction Traffic

66. There will be peaks with construction traffic as the work progresses. Foundation work necessitates bulk steel and concrete delivery; as towers are completed steel delivery may overlap and at a time near to the last tower being erected heavy winching plant will be moved onto site. Line construction workers plus supervisors will need to access sites on a daily basis. The highest density traffic will come from steel and concrete delivery. Cranes and heavy plant typically mobilise and demobilise less frequently.

Construction effects

67. There is a range of potential effects that can arise from the construction works as I have described above. Of these, the main effects and relevant management measures are outlined as follows.

Sedimentation runoff from freshly disturbed soils

Management measures: good design, water tables constructed with adequate sedimentation control from runoff.

Batter (cut slope) instability

Management measures: good design, construction practice to ensure banks are not cut too steep, and reinstatement such as hydro seeding following construction.

Visual impact of large benched areas

Management measures: keep areas to a minimum, use of helicopters if it is not possible to create safe laydown area, reinstatement with reprofiling sites to more natural shape, including replacement of previously removed material, followed by hydro seeding and replanting after all works are complete.

Disposal of excavated soil material tailings on site

Management measures: contain tailings and remove to approved disposal sites as work progresses

Disposal of groundwater from excavations

Management measures: carefully discharge groundwater across land for return to soil, if highly silted then may need to pass along siltation traps.

Visual footprint of the upstand or the pile cap above ground level during tower construction.

Management measures: control design to achieve smallest upstand feasible for tower type

Noise from helicopters (if used)

Management measures: comply with NZS 6803 (as this site is remote, there is low risk of non-compliance); additionally liaise with landowners for stock movement during helicopter use.

Stock disturbance and farm operation disturbance

Management measures: timely liaison with landowners to plan around farm operations, keep sites compact to minimise grazing areas disturbed, minimise traffic methods and adhere to access tracks and reinstatement as soon as works are complete.

Disruption to other parties' access ways

Mangement Measures: erect protection hurdles allowing traffic to proceed.

Terrain or vegetation damage from ground pulling conductors, or dismantling towers

Management measures: protect fences and roads from conductors with hurdles; pull conductors sideways away from vegetation, or lift by helicopter or tension de-string; keep all excavations as compact as possible, and reinstate all disturbed ground following the works.

Timing and management of construction process

68. The construction process is typically managed by a Project Manager from Transpower who has overall accountability to deliver the project. This person may be assisted by project support personnel dependent on the phase of the works. This team are responsible for getting all aspects of the works coordinated including detailed design, material schedules and ordering, all stakeholder management and ensuring completion to an agreed program. Contracts will be let for key aspects such as the major construction and linework. These are managed by the project manager. Key contractor representatives will manage the day to day site works and may liaise directly with landowners.

69. The management of the crews is through the agreed project structure. Typically for line work one contract is let to a Line construction company and they then manage the day to day works and any sub-contract components. Multiple crews will require additional supervision. Foundation crews for instance would be separate from linework crews, Tower building crews however may assist in the wiring of the towers. Regular meetings between the contractor management team and the Transpower Project Manager ensure work is continuing as per the agreed program.

70. An overall construction program will be developed to meet the constraints of the project. Key inputs include the road construction program and outages on the transmission line to enable deviated sections to be commissioned. In all instances it is both necessary and preferable the deviations are completed before the road works take place.

71. Foundation installation typically takes 5 days per site, but is very dependent on soil conditions encountered. Sites in good soil conditions can be completed in one day and difficult sites may take as long as 20 days. The 25 sites on this project would have a duration programmed for 25 weeks for one crew.

72. Tower building commences once sufficient foundations are ready and have had 28 days concrete curing time. Tower assembly and erection for these smaller towers will take 2-3 days per tower per crew.

73. Once a section is completed the conductors would be strung onto the towers prior to a planned outage to connect the deviation onto the main line. Installing conductor typically would take 5-12 days dependent on

the section length and weather. An outage to connect each deviation into the main line will take 2-3 days per circuit.

74. A typical construction program would have vegetation, access and site benching occurring early ahead of foundation installation crews. Once sufficient sites were prepared then the foundation crew would commence. This would continue until sufficient sites were ready to allow continuous work for a tower building crew to assemble and erect towers. The towers for several deviation sections would be completed and then a wiring crew would install the conductor. Tower building crews would assist in wiring. Outages on the Line will be pre-planned and the commissioning of the new deviations sections will occur incrementally. Access and foundation crews will continue as outages occur.

75. Crews typically work 10-11 hour days dependent on weather and phase of work. As lineworks have to mobilise from depots around New Zealand they have usually work a 12 days on 2 days off. Crews can only work a specified number of hours during this period to manage fatigue issues.

76. Key to successful completion of the works will be detailed planning. Meetings with key stakeholders, in particular NZTA, to agree on key dates will ensure the lineworks will not delay the road construction works. All agreed dates and responsibilities are documented in the Project management plan and linked program. This will then drive individual contractor site plans and work method statements.

Proposed Conditions of Consent

77. I am familiar with the proposed conditions of consent that are set out in the application, including the requirements for a Construction Environmental Management Plan (CEMP).

78. I am accustomed to working on projects that are the subject of conditions similar to these, and from a project implementation perspective I am confident the conditions are workable. In particular, I am used to working with management plans, and I support conditions that will enable a CEMP to be finalised after consent is granted. From a project management perspective that is critically important, because specific measures need to be designed to meet each of the CEMP requirements set out in proposed condition TL17; and the design of those measures must be undertaken in conjunction with the appointed contractors.

79. Based on my experience of the types of effects that works of this kind give rise to, I am also confident that the proposed CEMP and related conditions will be adequate to ensure that construction-related effects of the project will be suitably managed and controlled. As a project manager I have been responsible for other Transpower projects that have been the subject of similar conditions, and my experience from such projects is that conditions of this sort provide an effective framework for controlling and managing all the construction-related effects.

Conclusions

80. The Line Relocation Works affect a key operational transmission asset and all works will need to be carried out following careful planning and implementation of industry standard work practises and comprehensive management systems.

81. The Works will be undertaken according to best practice industry techniques, and a key focus will be ensuring that there is minimal risk of loss of supply, and that construction effects are suitably controlled and managed. The measures proposed to manage construction effects are workable and from a project management perspective I anticipate they will be effective.

Jon Mason
18 November 2011