

**BEFORE THE BOARD OF INQUIRY**

**IN THE MATTER** of the Resource Management Act 1991

**A N D**

**IN THE MATTER** of Applications for Resource Consent and Notices of Requirement by Transpower New Zealand Limited for the North Island Grid Upgrade Project

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**STATEMENT OF EVIDENCE OF ALASDAIR DAVID ANGUS GRAY  
ON BEHALF OF WAIKATO DISTRICT COUNCIL**

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## **Introduction**

1. My name is Alasdair David Angus Gray. I hold a Bachelor of Science degree (Civil Engineering, 1986) from the University of Aberdeen. I am a Corporate Member of the Institution of Professional Engineers New Zealand and a Chartered Professional Engineer.
2. I have worked in the transportation field as a civil/transportation engineer for more than 20 years and have been involved at a senior level in the investigation and development of projects in Waikato District and the Waikato region for more than 10 years.
3. I am based in Hamilton and established my own consultancy, Gray Matter Ltd, in January 2006. For 5 years prior to that I was Group Engineer, Asset Development, with Opus International Consultants Ltd in Hamilton, managing approximately 30 technical staff in a range of road projects. For the previous 5 years I was a senior civil/transportation engineer with Maunsell in Hamilton, where my duties included managing the materials testing laboratory manager.
4. I am familiar with the issues arising in and around Waikato District, having provided advice to Waikato District Council and other local authorities, Environment Waikato, Transit NZ, and developers on projects in the area over the past 12 years. I have the following specific experience with respect to the matters currently in front of the board:
  - Consultant civil/transportation engineer for Road Controlling Authorities assisting in the review of consent applications including the WEL and Contact wind farm developments, mining, quarries, plan change proposals, and industrial, commercial and residential developments

- Consultant civil/transportation engineer for developers, landowners and local authorities preparing traffic impact assessments for developments proposals including quarries, landfills, special events, residential developments and sporting and exhibition venues
- Team Leader for the State Highway 2 Strategic investigation, including scoping studies for the SH1/SH2 interchange and Kopuku section, investigation and designation of the Maramarua Deviation, and construction of the SH2 Pokeno to Mangatarata Safety Improvements project
- Team Leader and reviewer for the Waipa District Council road rehabilitation investigation and design programme for 5 years
- Investigation and implementation of town centre upgrades and redevelopments including Ngaruawahia, Huntly, Morrinsville, Cambridge, and Rotorua
- Team Leader for the State Highway 3 Te Awamutu and Kihikihi Traffic Study
- Team Leader for the Te Awamutu Western Arterial and Alexandra Street Heavy Traffic Options - Te Awamutu Town Centre.

### **Summary of evidence to be presented**

5. I have been retained by Waikato District Council to provide evidence in support of their neutral submission in relation to Transpower's Notices of Requirement and Applications for Resource Consent and, in particular, the Overhead Line Notice of Requirements (Reference

Number DES0011/07). My focus is on Part 1 of the Waikato District Council Submission relating to construction effects on local roads.

6. I confirm that I have read and am familiar with the Code of Conduct for Expert Witnesses in the Environment Court, Consolidated Practice Note (2006), and agree to comply with that Code of Conduct. I have relied on the statements of evidence of Mr Rasul, Mr Patrick and Mr Prince listed in paragraph 7 for additional information on the proposed overhead line and its construction. Where it may be helpful for cross-reference, I have listed the evidence and paragraph number (name/number) in my statement.
  
7. My evidence is based on the information presented in the Transpower New Zealand Ltd North Island Grid Upgrade Project Notices of Requirement Documentation Part VI to IX and Part X Section 11 to 18 and the evidence of:
  - Peter Rasul (Overview of Construction Processes: Lines)
  
  - Philip James Patrick (Construction Processes and Management: Lines)
  
  - Glen Malcolm Prince (Transport/Traffic Issues).
  
8. My evidence focuses on construction traffic effects and is in five parts, comprising:
  - An overview of the concerns raised by Waikato District Council in Part 1 of their submission
  
  - A summary of my interpretation of the information presented in the Notice of Requirement Documentation and evidence in

support of Transpower, and my assumptions for evaluations of impact

- My preliminary assessment of the potential impact of the proposed overhead line proposal on local roads in the Waikato District
- Options for mitigating or remedying the adverse affects of the additional traffic associated with the project
- My conclusions.

#### **Overview of concerns raised by Waikato District Council**

9. The WDC submission raises concerns about the volume of heavy traffic during the construction phase and its impact on the local road infrastructure. WDC's concerns are based on:

- The nature of many of the local road pavements that are simply sealed metal roads with no specific design. These appear adequate for typical rural activities with maintenance taking place as required
- The increase in heavy traffic (volume and loading) and its likely immediate adverse effects on the road surface and long-term effects in reducing the expected life of the road before it requires to be renewed
- WDC's experience from the damage caused to local roads by construction traffic for Transpower's Ohinewai Switching Station at Storey Road, Waiterimu. In that case, I understand that there was a significant change in the approach route for construction traffic because a different quarry source was

selected. This resulted in significant damage to the surface during construction that required reactive maintenance, as well as a significant change in the amount required to offset the impact of heavy traffic on pavement life.

- The lack of consideration of construction traffic effects or mitigation in the Notice of Requirement Documentation
- The lack of information on traffic from the decommissioning and removal of the ARI-PAK A line.

#### **Interpretation of the notice of requirement information and Transpower evidence**

10. Quantifying the likely traffic from the information available on the overhead line project is difficult. There is a wide range of tower types and locations, associated foundation options and sizes, construction methods and access options. I appreciate that the design of the project is at an early stage and that some of the information will not be available until more detailed investigation and design is completed and construction methods have been selected. In addition, the purpose of the proposed construction procurement method of alliance contracting (Rasul/11) is to permit flexibility and collaboration in design and construction. Some of the information will not therefore be known until the final decisions about how to proceed are taken during construction. However, some idea of the impact is necessary in order to assess the potential impacts and guide development of methods of mitigation to protect the Waikato District Community and local road users from adverse effects as has been the case for the Ohinewai Switching Station.

11. The Notice of Requirement Documentation Part VIII, 2.7.3 states that construction is expected to involve the following number of site visits per tower:
  - Heavy plant and vehicles: between 15 to 50 visits
  - Light vehicles: up to 100 vehicles
  
12. The Notice of Requirement documentation also describes:
  - Access tracks 4m – 5m wide with imported hardfill/basecourse (VIII, 2.7.1.2),
  - Installing or upgrading culverts, bridges and other water crossings (VIII, 2.7.1.2)
  - Tree and debris removal (VIII, 2.7.1.3, 2.7.1.7)
  - Foundations – e.g. bored piles 1.2m diameter x 7m deep (VIII, 2.7.1.4)
  - 12 – 54T steel – 2 to 10 trucks (VIII, 2.7.1.5)
  - Storage areas (1 to 4 ha fenced hardstanding, roads and drainage) (VIII, 2.7.2)
  - House/building removal (VIII, 2.7.5)
  - Dismantling/Removal of Existing ARI-PAK A line
  
13. The Notice of Requirement Documentation refers to the provisions of the operative Waikato District Plan as useful guidelines. The key provisions listed in (VIII, 3.6) do not include Transportation.

14. The effects on roads appears to be described in (VIII, 5.2.8) Effects on Existing Utilities. This includes the potential for damage to the formation of roads, but relies on generic mitigation requiring the construction contractor to liaise with utility owners and take the precautions necessary to avoid damage or unplanned disruption. In my view this is inadequate and too late
15. The construction traffic and access effects of the project are described in (VIII, 5.2.9). There is no information on the quantity or types of traffic or roads affected. The assessment refers to Section 18 of Part X, based on an earlier alignment with some tower numbers and locations changed.
16. Mr Rasul's evidence gives an overview of construction processes and contains the following points relevant to traffic:
  - Alliance contracting – flexibility in scope and approach to work (Rasul/12)
  - Time for construction and workforce involved is anticipated (Rasul/22-27)- this leads to uncertainty
  - Contractor facilities (Rasul/32) – comment: this may mean double handling and therefore increased traffic
  - Construction Management Plans (Rasul/48) to be implemented by the Alliance. Transpower's tender documents would require that the Construction Management Plan address matters including traffic/access management – comment: there is no information on the timing of approval of this plan or Road Controlling Authority input to it

- Access (Rasul/66) – approximately 60% of tracks would be existing tracks upgraded for construction 40% of access tracks would be new, with the extent, type of access dependant on construction approach and season – comment: this could lead to substantial variations in traffic routing and volumes.
- Foundations (Rasul/75) – diameters 900mm to 2400mm, depths from 7m to 15m – comment: this differs from the 1.2m diameter and 7m depth in the Notice of Requirement Documentation. For four footings per tower, the Notice of Requirement implies four truckloads of concrete (18 cu m) and Mr Rasul’s statement up to 54 truckloads (271 cu m).
- Reinstatement (Rasul/87) – surplus materials and access roads would be removed – comment – this could significantly increase traffic volumes.
- Works to public roads (Rasul/100) would be carried out with the agreement of the relevant authority – comment: the information made available, the basis of procurement and uncertainty of construction approach will make it difficult for Waikato District Council to know what sort of work may be necessary, and what form of agreement would be appropriate to protect the road infrastructure.

17. Mr Patrick’s evidence describes the construction processes and management for lines and contains the following points relevant to traffic:

- Site Works Plans, including approved access routes to each work site, measures to be taken to protect infrastructure and the nature of materials to be used as toppings on roads (Patrick/19)

– comment: this appears to be when the access arrangements are first fixed and traffic volumes realistically estimated

- Foundation concrete volumes up to 80 cu m (Patrick/44)-  
comment: this is higher than the Notice of Requirement quantity of 18 cu m and less than Mr Rasul's upper estimate at 271 cu m
- Access tracks (Patrick/47) – range of options and alternative of helicopter.
- Access tracks (Patrick/49, 52) – 4m wide, most would be metalled
- Potential impacts from track construction and site preparation (Patrick/55) The Access and Construction Assessment example makes a generic statement about new vehicle accesses onto public roads will comply with the requirements of the appropriate local authority. – Comment: the effects listed do not consider heavy traffic impact on the roads. This is, in my view, a significant oversight. The appropriate location for a road entranceway may not match the proposed internal access arrangements. Access routes and entranceway changes should be agreed early and prior to Transpower committing to access and construction arrangements.
- Vehicle movements during foundation construction (Patrick/97) estimating 80-1000 one way vehicle movements for a range of types– comment: traffic volumes appear to be significantly greater than Notice of Requirement Documentation upper estimate of 300 total for a complete tower

- Increased traffic volumes on roads (Patrick/104) recognizes the potential for wear and tear and states that the Alliance will implement traffic management plans where disruption has the potential to be problematic and where required by the owner of the road. Mr Patrick states that he understands that the Local Government Act 2002 makes provision for Councils to recover contributions to road maintenance from developers but does not explain how Transpower intend to mitigate or remedy the adverse impacts of the heavy traffic from the project.
- Wiring sites (Patrick/129) would have up to 1500 vehicle movements per wiring site. Comment: The location and number of these sites was not readily evident.
- Potential impacts associated with removal of ARI-PAK A line (Patrick/197) – comment: traffic effects are not considered.
- Response to Fuller property submission (Patrick/204b) – 2000 to 2500 vehicle movements (3 tower sites) including access tracks, earthworks, removal of trees, dismantling ARI-PAK A line. Comment – Approximately 750 vehicle movements is significantly higher than the upper estimate of 150 vehicles (300 movements) in the Notice of Requirement Documentation
- Response to Seales property submission (Patrick/206) – 220 to 565 vehicle movements per tower for two tower sites
- Response to Lichfield Farms property submission (Patrick/211 - 213) – Mr Baker suggests 935 truck movements in/935 truck movements out for eleven tower sites. Mr Patrick suggests 220 concrete truckloads for foundations. Comment: based on the Fuller property response there could be over 8000 (=11 x 750) vehicle movements at this property. The proportion of heavy

vehicles to light vehicles set out in the Notice of Requirement Documentation (15- 50 heavy – up to 100 light) suggests that heavy vehicles make up 10% to 35% of the construction traffic. For the Lichfield Farms property, this would mean 800 to 2800 truck movements.

- Adequacy of existing road infrastructure and damage caused through use by construction vehicles (Patrick/217,218) – Comment: Mr Patrick identifies Stakeholder Management Plans as requiring substantial consultation with rural road owners (District Councils) and refers to the Local Government Act 2002 for possible development contributions. Stakeholder Management Plans are described by Mr Rasul (Rasul/58, 59). They appear to be communication mechanisms and do not include for mitigation for impacts on roads, agreeing entrance and access arrangements, preferred access routes etc.

18. Mr Prince's evidence considers transport and traffic issues for the whole project and includes the following points relevant to heavy traffic:

- Permanent ongoing traffic effects are negligible (Prince/6) – comment: I agree with this conclusion subject to the locations of entranceways being safe and appropriate, and the necessary clearances being maintained that would allow for any likely road upgrades that may change the vertical alignment of roads in the proximity of the line road crossings.
- Traffic related issues raised by submitters can and will be addressed by Transpower (Prince/15, 16). Comment: The construction management processes and responses to submitters are not sufficiently detailed to address Waikato District Council's concerns relating to heavy traffic impact. It would be appropriate

to have conditions agreed in sufficient detail to avoid disputes about the arrangements for the designation. There does not appear to be any response to the Waikato District Council submission relating to heavy traffic.

- The traffic evidence is dominated by the underground routes and transformers (Prince/39 – 53 relate to the overhead line). Comment: I note that Transpower will undertake a carriageway condition survey with Manukau City Council (Prince/184, 253) but that there is no indication of how Transpower will remedy or mitigate Waikato District Council's concerns
- Tower foundations (Prince/40) 16 to 60 concrete truck movements: Comment: different quantities to those in other statements and higher than the Notice of Requirement Documentation.
- Consent conditions (Prince/53) including construction management plans, traffic management plans and an effective communications plan involving consultation and liaison with affected parties such as road controlling authorities. Comment: These do not appear to consider heavy traffic impacts for Waikato District local roads, although Transpower appears to have worked with other road controlling authorities to address their concerns.

19. Based on the Notice of Requirement Documentation and evidence, I estimated the number of trucks for some of the towers in Waikato District and assessed a typical number of heavy vehicles per tower to be approximately 245. 245 trucks appears to be reasonably consistent with the information in the Notice of Requirement Documentation and the evidence in support of Transpower. The estimate of trucks allows for:

- Materials and equipment to and from the state highway corridor:
    - Material required for track surfacing (assumed track lengths)
    - Deliveries of steel, concrete, miscellaneous materials, plant and equipment
    - Removal of old lines, debris and reinstatement
  
  - Movement of materials and equipment between tower sites
20. Realistic assignment of trucks to the local road network is not possible with the information available. I therefore prepared a very coarse assessment and assignment, presuming that all equipment and materials would come from the north or west via the state highway network. I presumed that construction traffic would use roads such as Kopuku Road from the north for approximately 45 towers and Tahuna Road from the west for approximately 70 towers in the Waikato District and 18 towers in Matamata Piako. Between the main access roads, I considered that the traffic would use local access roads such as such as Taniwha Road, Flaxmill Road and Waugh Road.

#### **Preliminary assessment of potential impact on local roads**

21. I generally agree with the assessment that the ongoing traffic effects of the project will be minor, but only if any permanent entranceways are properly located and designed. The locations of entranceways will influence access arrangements and construction methods and therefore should be the subject of early agreement with Waikato District Council.
22. I also agree that with the assessment that the efficiency and safety impacts of the construction stage of the project will be minor of

Requirement, but only if the surface condition of the affected roads is adequately maintained and appropriate temporary traffic management carried out. COPTTM is the appropriate code of practice for temporary traffic management. The selection of appropriate access routes should be carried out in discussion with Waikato District Council. These routes may influence access arrangements and construction methods and should be the subject of early agreement with Waikato District Council.

23. The Waikato District Council submission raises concerns about damage to the pavement by heavy traffic. The likely damage from heavy traffic loading takes two main forms:
  - Surface damage where the loading on the pavement damages the integrity of the pavement surface, resulting in surface deformation or potholes, leading to further damage from water penetration or direct effects on the pavement or subgrade
  - Accelerated subgrade damage which reduces the effective life of the pavement.
24. The surface damage is difficult to predict, should be easy to observe and early responsive maintenance can minimise further damage. Since the effects are localised and depend on existing pavement condition, traffic loading and any manoeuvring, it would be appropriate for pavement condition monitoring and maintenance procedures to form part of temporary traffic management planning.
25. Accelerated subgrade damage results from heavier traffic loading than the pavements are designed for, causing increased deflection and increasing the likelihood and extent of plastic deformation. For the lower volume local roads, the pavement is often thinner than would be designed for the existing traffic, increasing the likelihood of damage.

26. Typical methods for assessing the impact of activities that increase heavy traffic take into account the likely performance of the existing pavement under the increased traffic in terms of design life, and a comparison of the existing pavement depth with the depth required to withstand the additional loading.
27. Using the approximate estimates summarised in 19 above, and the coarse assignment described in 20 above, I made a preliminary assessment of the impact of the heavy traffic to establish how significant it was likely to be. This is not put forward as an accurate assessment. For simplicity, my assessment is based on the following assumptions:
- All pavements are half way through their design life
  - All pavements are capable of supporting the existing traffic (may not be the case)
  - Rehabilitation costs are nominally \$200,00/km
  - The time value of money is recognised by discounting costs to present values to provide a common unit of measurement. The discount rate represents the rate at which present costs can be exchanged for future costs. Costs are discounted to take this timing into account using present-worth factors from the Land Transport Economic Evaluation Manual Volume 1, based on a 10% discount rate.
28. The assessment uses Kopuku Road, Taniwha Road, Tahuna Road and Mangatea Road as examples, as set out in Table 1, showing the nominal pavement depths.

Road data				Nominal Design	Construction Effects	
Name	length	AADT	%HCV	Pavement depth	Pavement depth	Additional Trucks
	mm	Veh/day	%	mm	mm	Veh/day
<b>Kopuku</b>	14691	152	10	301	304	10800
<b>Taniwha</b>	12981	247	10	322	324	9800
<b>Tahuna</b>	24100	1064	10	386	387	17400
<b>Mangatea</b>	5848	54	10	257	258	1715

**Table 1: Road Data and Pavement Depths (existing and required for additional loading)**

29. The changes in pavement depth are small, between 0mm and 3mm. The differences will be more pronounced for low volume roads than for those with higher traffic volumes. However, when taken into account over many roads, the road width and the extended lengths being considered for the Grid Upgrade Project, the material cost can be significant.

30. The other assessment method based on reduced pavement life also shows an apparently small difference.

Road data				Current		Construction Trucks Effect		
Name	length	AADT	% HCV	Pavement depth	Life	trucks	Pavement depth	Life
<b>Kopuku</b>	14691	152	10	301.4	25	10800	303.6	24
<b>Taniwha</b>	12981	247	10	322.4	25	9800	323.6	24.5
<b>Tahuna</b>	24100	1064	10	385.7	25	17800	386.2	24.75
<b>Mangatea</b>	5848	54	10	256.8	25	1715	257.8	24.5

**Table 2: Road Data and Pavement Life (existing and expected after additional loading)**

31. The differences in pavement thickness are valued in terms of equivalent additional overlay cost and the impact of the reduction in life is taken into account by comparing the present value costs of reconstruction as set out in Table 3.

<b>Road data</b>	<b>Current</b>			<b>Construction Effect</b>				
<b>Name</b>	<b>length</b>	<b>Pavement depth</b>	<b>Life</b>	<b>Pavement depth</b>	<b>Reduced Life</b>	<b>Difference in PV factor</b>	<b>Loss of Life</b>	<b>Equivalent Overlay</b>
<b>Kopuku</b>	14691	301.4	25	303.6	24	0.029	\$84,900	\$19,250
<b>Taniwha</b>	12981	322.4	25	323.6	24.5	0.014	\$37,500	\$9,250
<b>Tahuna</b>	24100	385.7	25	386.2	24.75	0.007	\$34,850	\$7,200
<b>Mangatea</b>	5848	256.8	25	257.8	24.5	0.014	\$16,900	\$3,500

**Table 3: Road Data, Equivalent Overlay and Pavement Life – PV Cost Impacts**

32. The overlay cost method may not be appropriate for this type of project, since the impact is from a single event rather than a continuing activity such as a quarry. The loss of life assessment better recognises the adverse effects of heavy traffic on the road network. The amounts in Table 3 are illustrative, but demonstrate that the potential impacts in terms of increased maintenance costs on the Waikato community may be in the order of hundreds of thousands of dollars.

**Options for mitigating or remedying adverse affects**

33. The options for mitigating or remedying adverse affects include:

- Early liaison and coordination between Transpower and Waikato District Council to achieve a balance between the project objectives and avoiding or minimising adverse effects on the local road network, including:

- Identifying desirable access routes to minimise pavement impacts
  - Identifying appropriate entrance locations
  - Agreeing methods for inspecting, monitoring, maintaining and restoring pavement conditions before, during and after construction
  - Linking these to the construction management plan
- Temporary traffic management planning including:
    - pavement condition monitoring and maintenance procedures during the project
  - Agreement between Transpower and Waikato District Council regarding how traffic volumes are assessed or monitored, and heavy traffic impact on the pavements evaluated
  - Compensation for the long term maintenance cost impacts.

## **Conclusions**

34. Transpower does not appear to have taken into account Waikato District Council's concerns regarding heavy traffic impact, although they have considered the effects on other road controlling authorities including Transit NZ and Manukau City Council.
35. The supporting evidence appears to rely on development contributions under the Local Government Act 2002 being adequate protection for the community against additional infrastructure costs but gives no explanation of how this would be done.
36. There is potentially significant variation between the Notice of Requirement Documentation and evidence, and the likely heavy traffic

generation and assignment to the road network is hard to interpret. While I accept that the project is at an early stage, and Alliance contracting means that changes are likely while construction is taking place, the project information should provide a realistic basis for planning the project and its management. The information should include which roads will be used by heavy construction traffic, the nature and traffic volumes that will use each section of road and proposed construction access locations.

37. There are means available that Transpower could implement to minimise the impact of the project on the local road network. These should be incorporated within the designation conditions, and include:

- Early coordination with Waikato District Council of access arrangements and temporary traffic management:
  - Access routes and temporary traffic management proposed
  - Locations for entranceways with design standards, visibility, etc.
- A requirement for Transpower to rectify any construction damage during the construction period, including:
  - Pre-construction condition surveys – such as video surveys
  - Reactive maintenance arrangements including:
    - Monitoring and inspection methods and frequencies during the construction period

- Whether Transpower wish to repair surface damage directly or work through Waikato District Council's road maintenance contracts
  - Response times and maintenance specifications. It would be appropriate to match Waikato District Council's practices.
- Agreement on how traffic volumes are assessed or monitored and how heavy traffic impact on the pavements evaluated and compensated for, including:
    - Agreeing a basis for compensation – equivalent overlay depth, loss of life, etc.
    - Maintaining forecasts of traffic routes and loadings and updating these as the construction planning progresses
    - Reporting actual routes and loadings where there is a significant variation
    - Compensating Waikato District Council for the heavy traffic impact.

**SIGNED** by

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**Alasdair David Angus Gray**