

Fatigue Through Nightshifts in Succession

Joint Coal Board Health and Safety Trust's
research priority on fatigue and stress.

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ARRB Transport Research Ltd.

data analysis
data
input
collection
assessment
collected knowledge
database

safety & efficiency for transport

environment

knowledge through research

Focus on Rosters and Shifts

- Debate on length of shifts (8 Vs 12)
- Focus on length of rosters
- Considerable argument over roster pattern

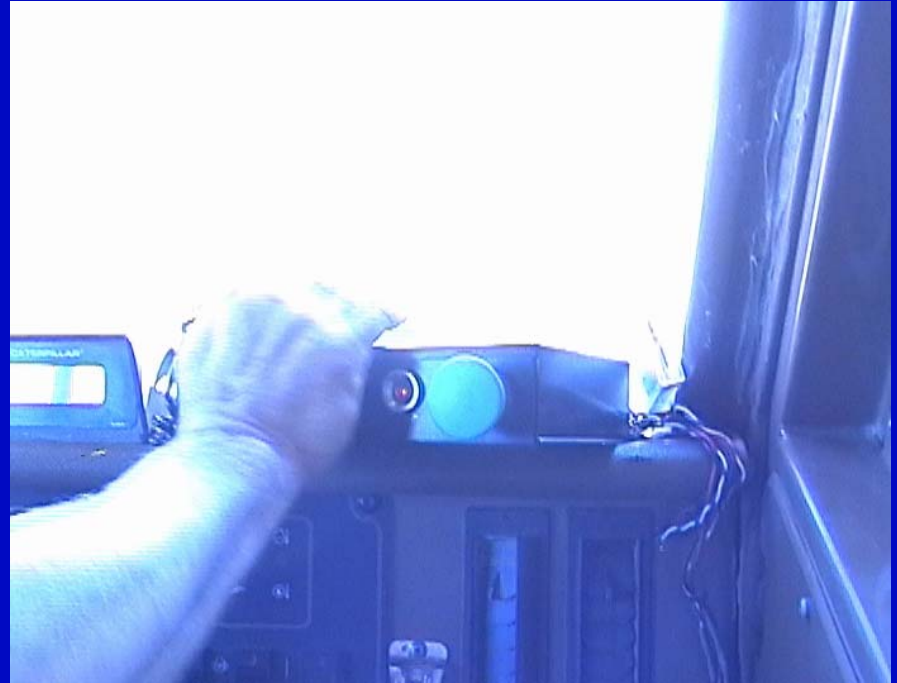


Research Questions to Answer

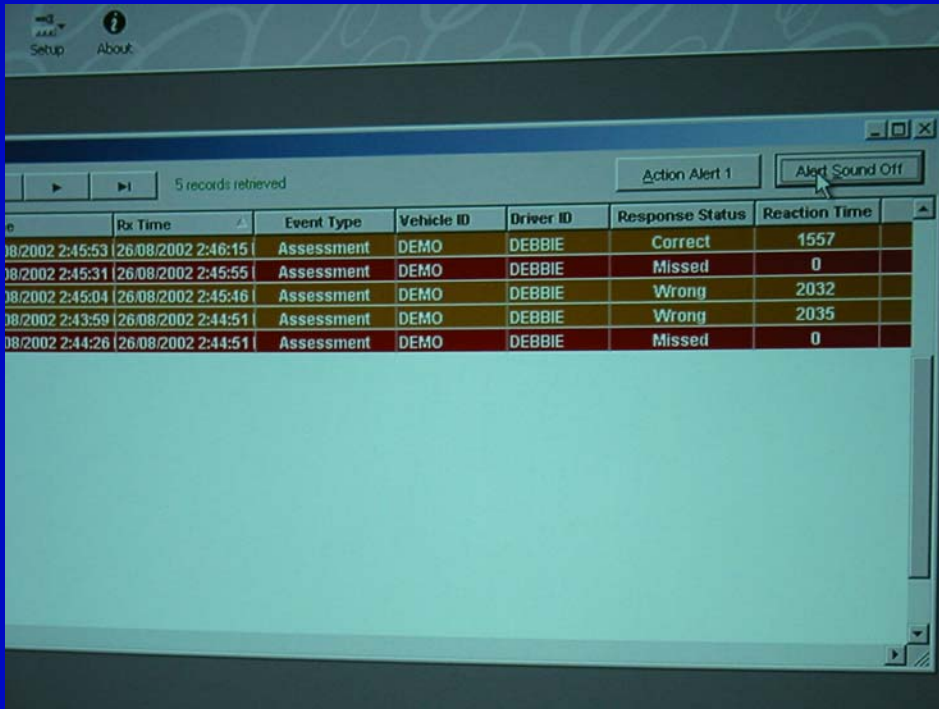
- 1 What is the most important contributor to acute fatigue in open cut mining? Is it length of shift (eg. 8 hours Vs 12 hours) or is it time of day (eg. circadian effects)?**
- 2 What is the limit of successive night shifts before chronic fatigue affects operator performance in open cut mines?**

Methodology

- **Funded by Coal Services**
- **Open cut mine selected**
- **8 haul trucks fitted with ARRB FMD**
- **Testing for slow reactions to stimuli**



Methodology



5 records retrieved

Rx Time	Event Type	Vehicle ID	Driver ID	Response Status	Reaction Time
08/2002 2:45:53 26/08/2002 2:46:15	Assessment	DEMO	DEBBIE	Correct	1557
08/2002 2:45:31 26/08/2002 2:45:55	Assessment	DEMO	DEBBIE	Missed	0
08/2002 2:45:04 26/08/2002 2:45:46	Assessment	DEMO	DEBBIE	Wrong	2032
08/2002 2:43:59 26/08/2002 2:44:51	Assessment	DEMO	DEBBIE	Wrong	2035
08/2002 2:44:26 26/08/2002 2:44:51	Assessment	DEMO	DEBBIE	Missed	0

- 24 drivers being tested for 10+ weeks (17 male & 7 female)
- 14 N, 1 off, 13 D, 7 off roster (12-hours)
- Collecting real-time performance data

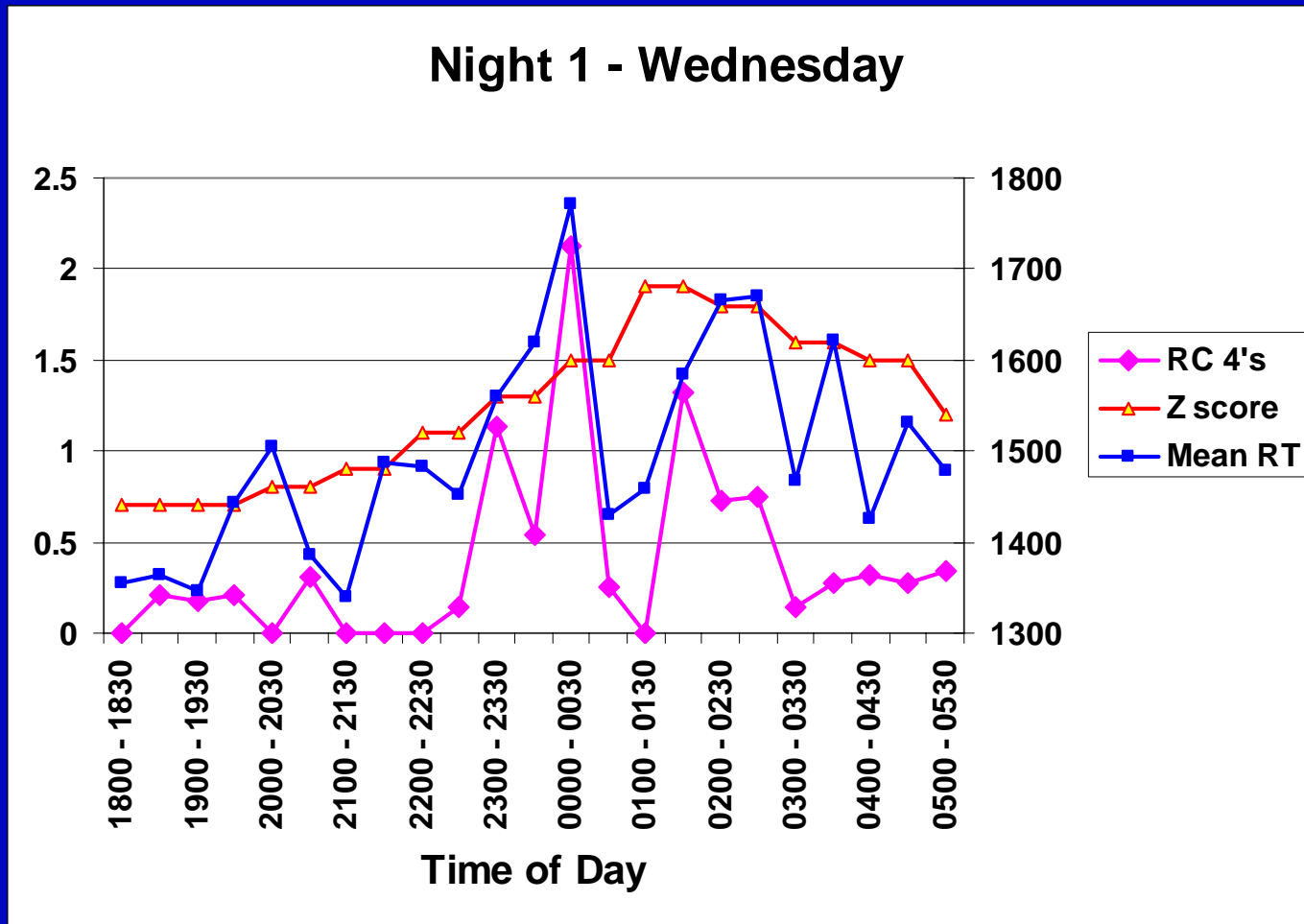
1 What is the most important contributor to acute fatigue in open cut mining?

- If the length of shift is the major issue, we should see lowered performance toward the end of the shift
- If it is circadian effects, we should see lowered performance during the circadian low points (0000 hrs to 0500/0600 hrs)



Length of Shift Performance Vs Circadian Influence - Shift 1

Night 1 - Wednesday



So What's the Answer to Q1???

What is the most important contributor to acute fatigue in open cut mining? Is it length of shift (eg. 8 hours Vs 12 hours) or is it time of day (eg. circadian effects)?

The data shows that:

- **There appears to be no length of shift effect.**
- **The circadian influence is very strong, however, it does not match sleep or crash data.**

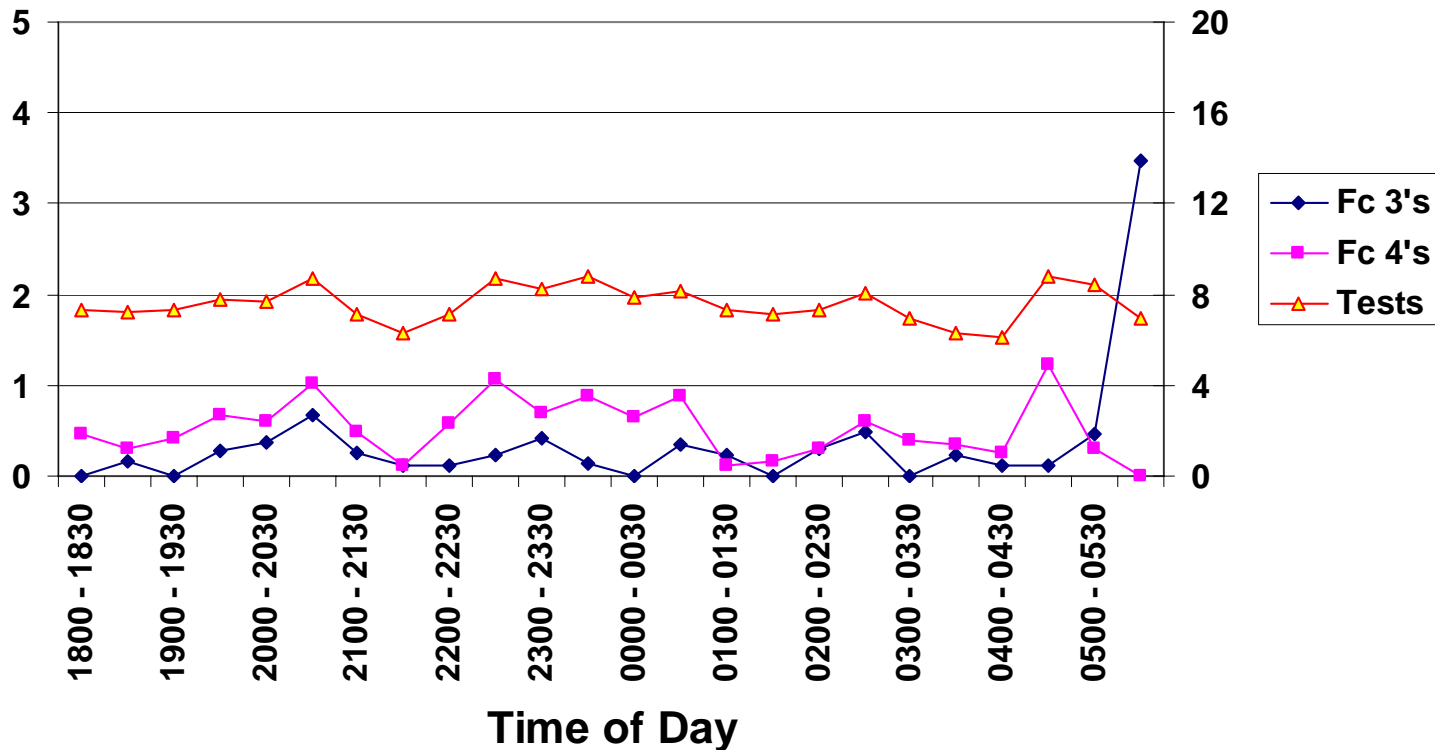
2 What is the limit of successive night shifts before chronic fatigue affects operator performance in open cut mines?



- Is there a cut-off point where safety is compromised by fatigue as measured by operator performance?

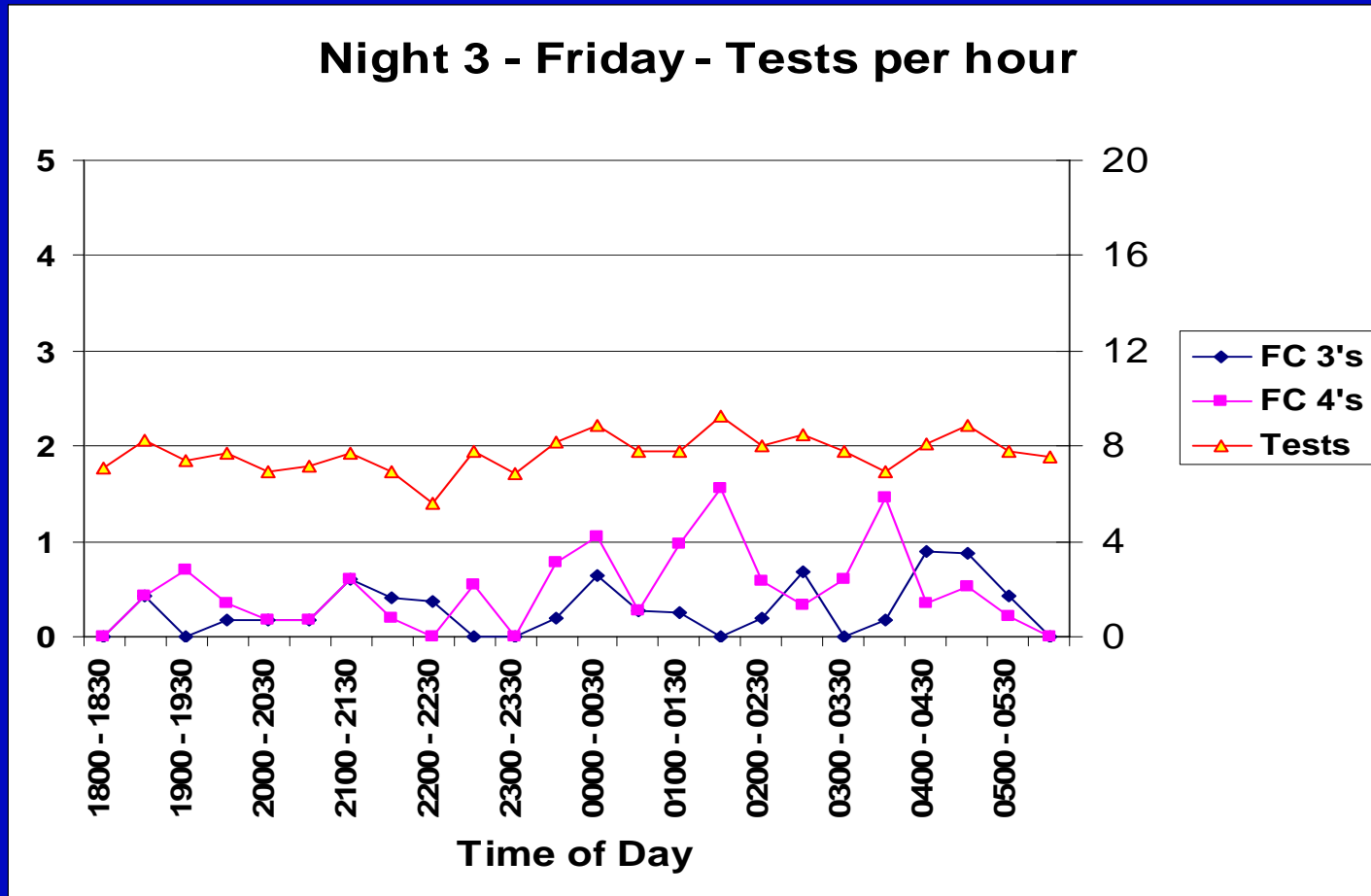
Length of Shift Performance & Circadian Influence - Night 2

Night 2 - Thursday - Tests per hour



Length of Shift Performance & Circadian Influence - Night 3

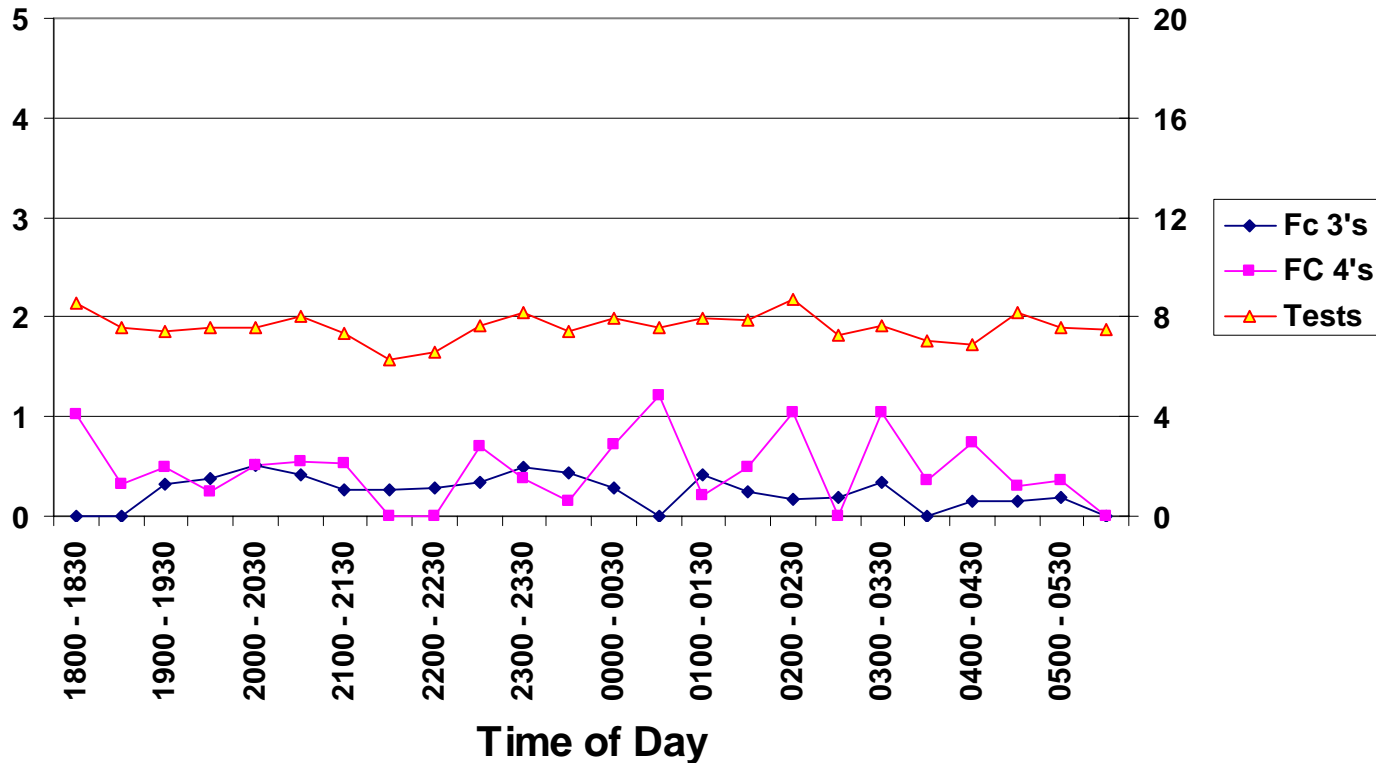
Circadian Influence - Night 3



Length of Shift Performance & Circadian Influence - Night 4

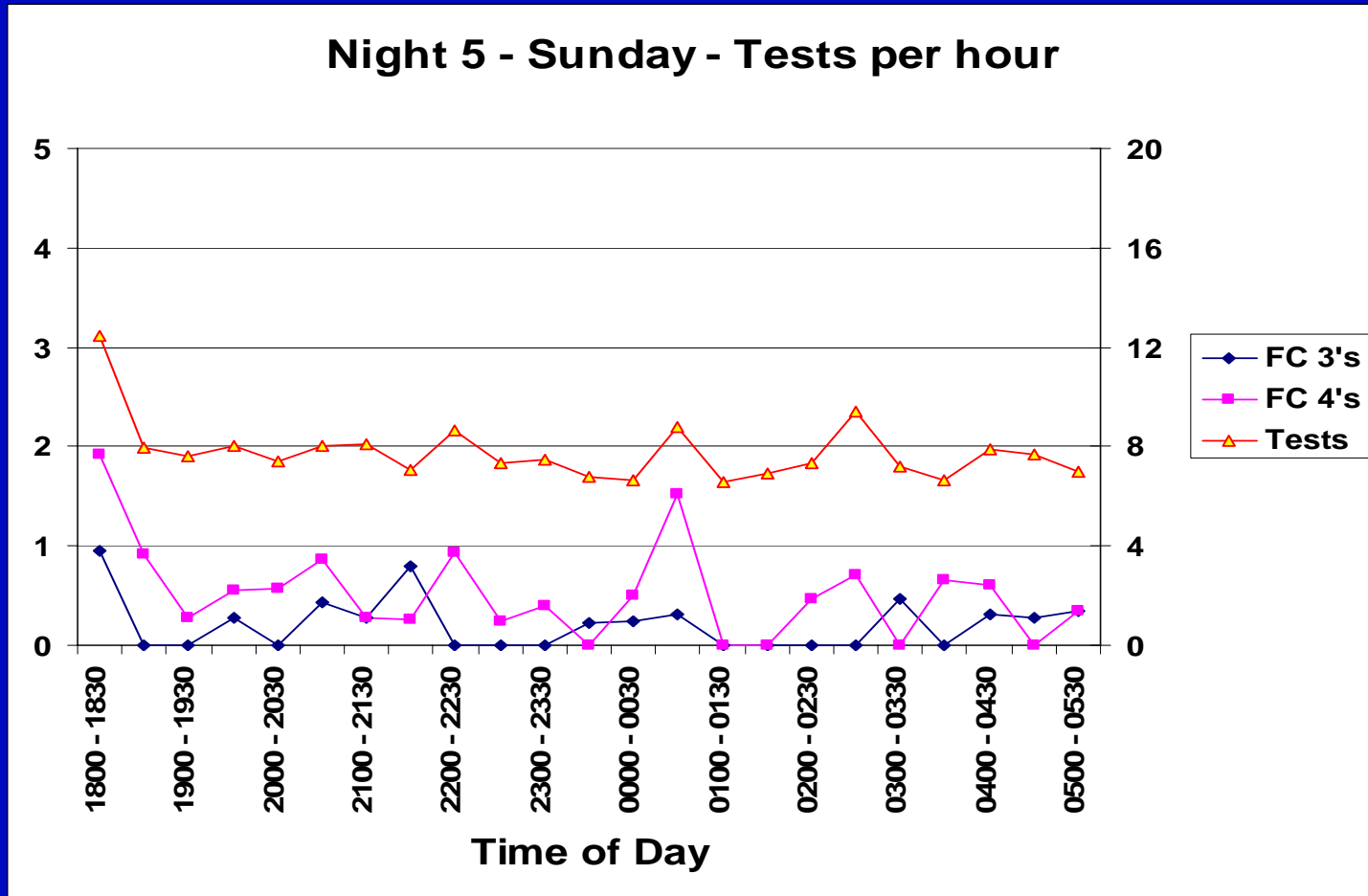
Circadian Influence - Night 4

Night 4 - Saturday - Tests per hour

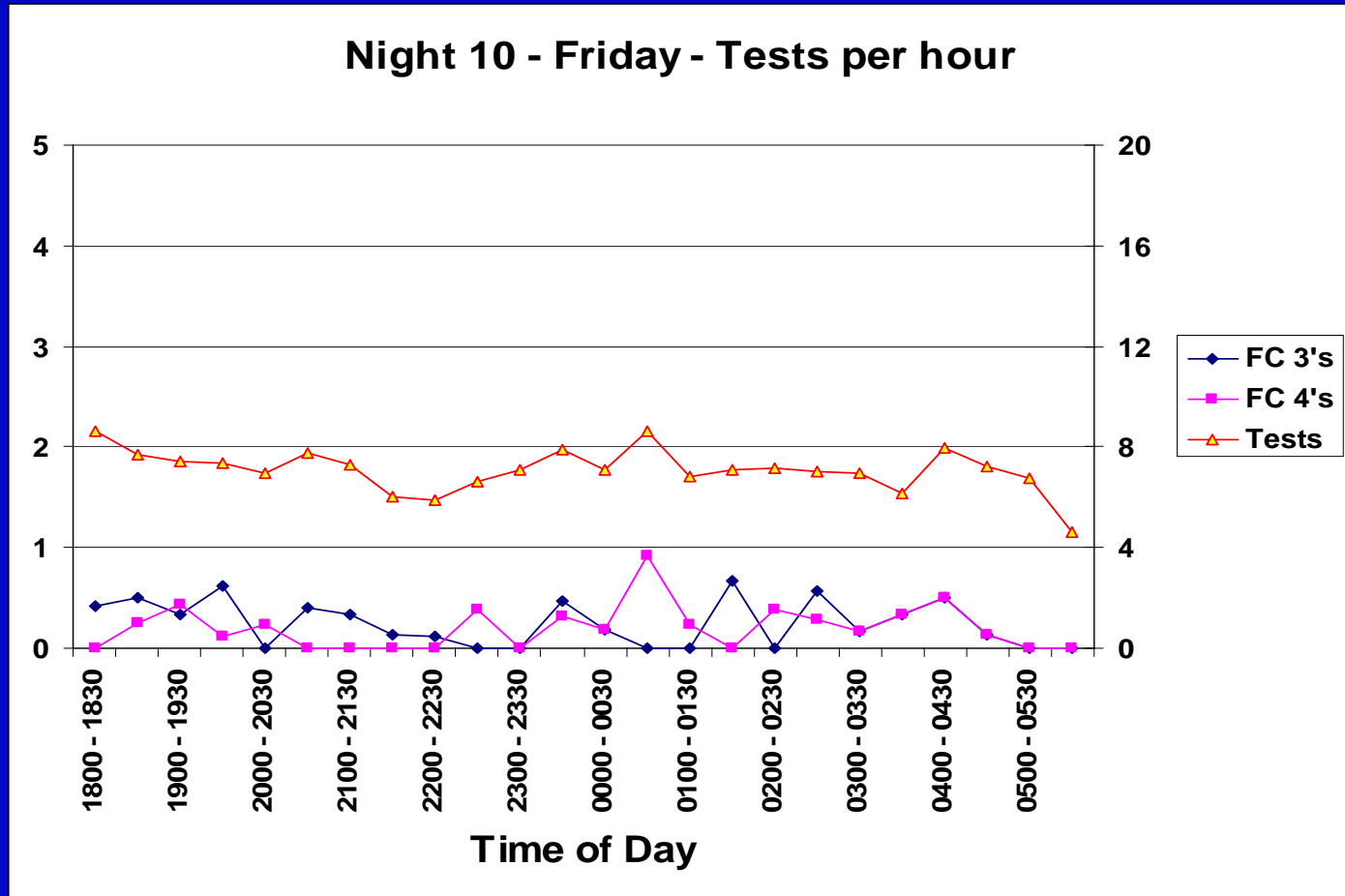


Length of Shift Performance & Circadian Influence - Night 5

Circadian Influence - Night 5

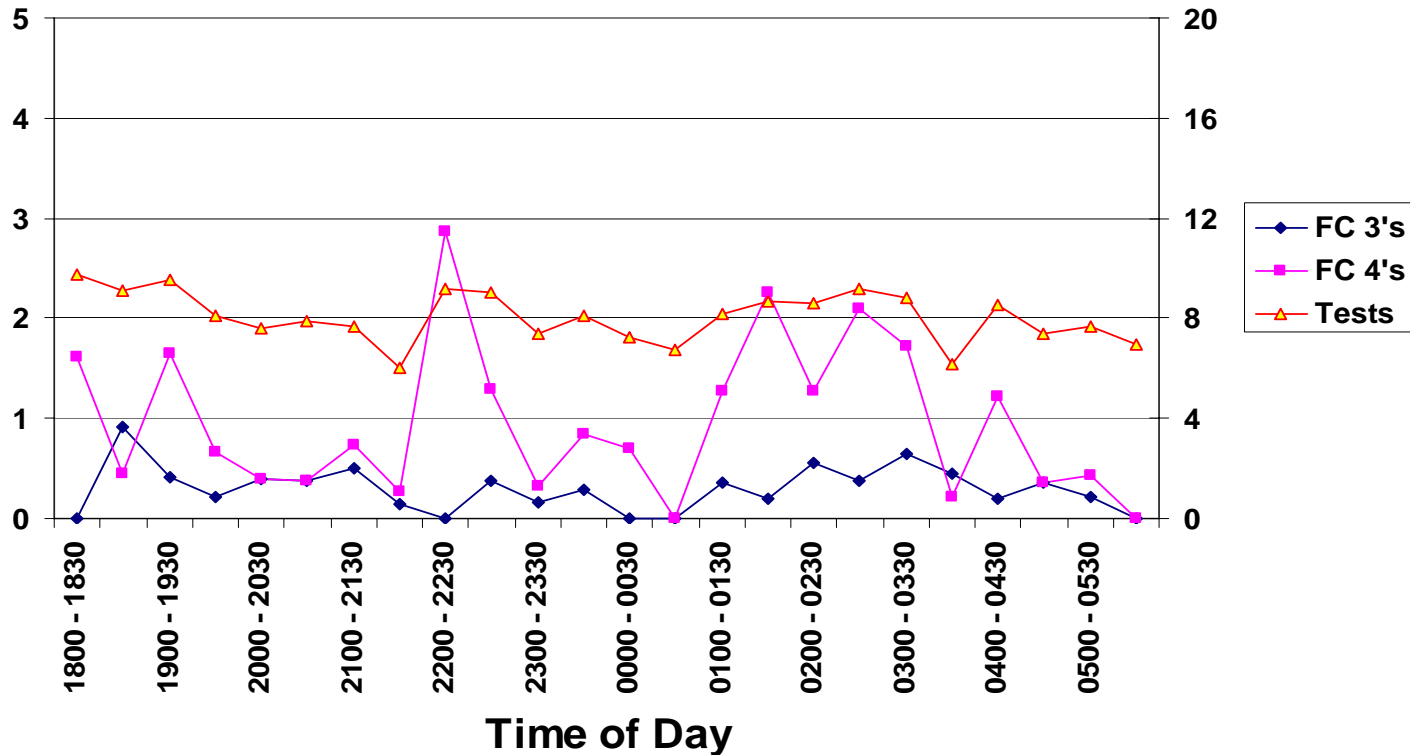


Length of Shift Performance & Circadian Influence - Night 10

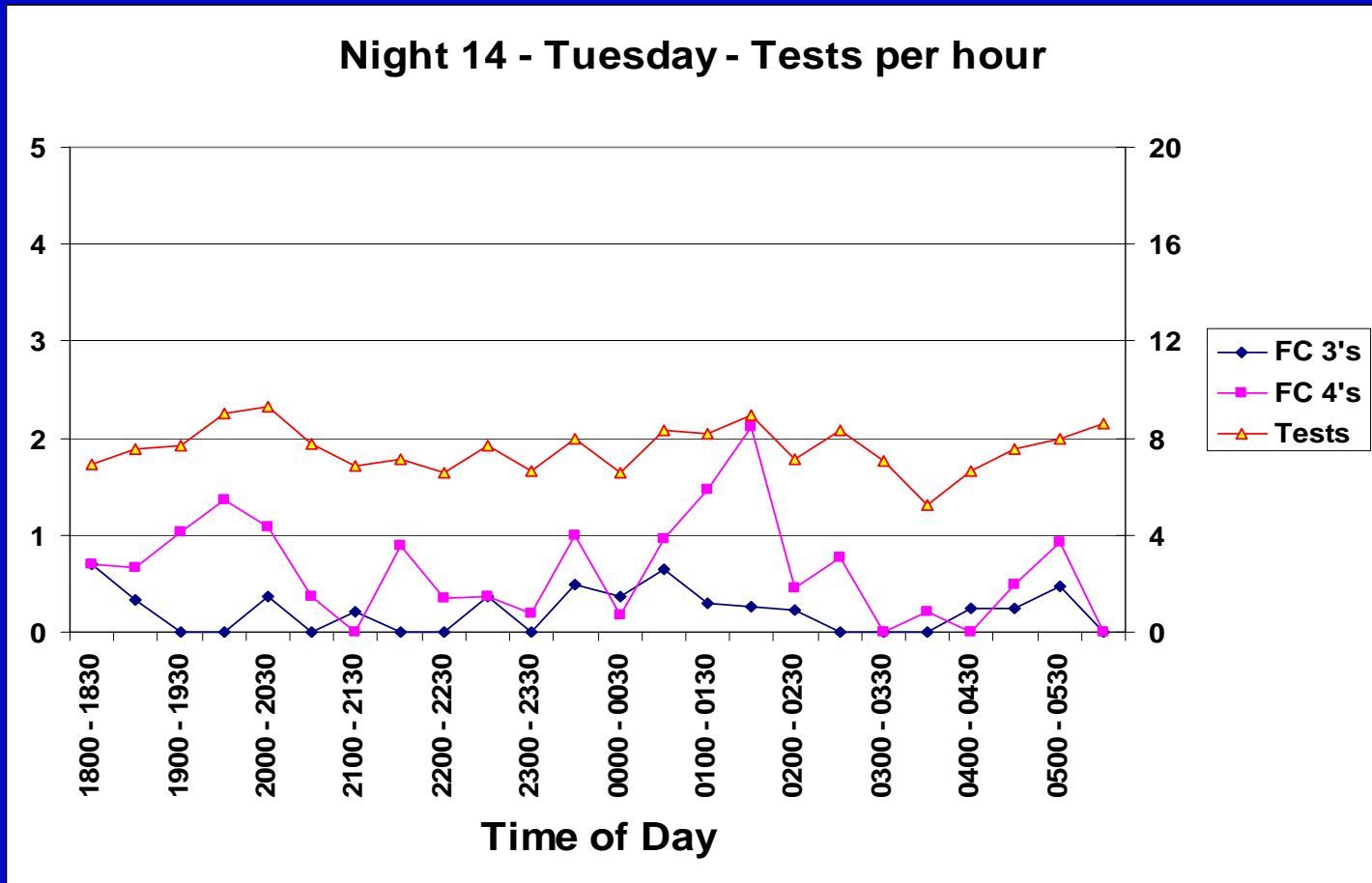


Length of Shift Performance & Circadian Influence - Night 13

Night 13 - Monday - Tests per hour

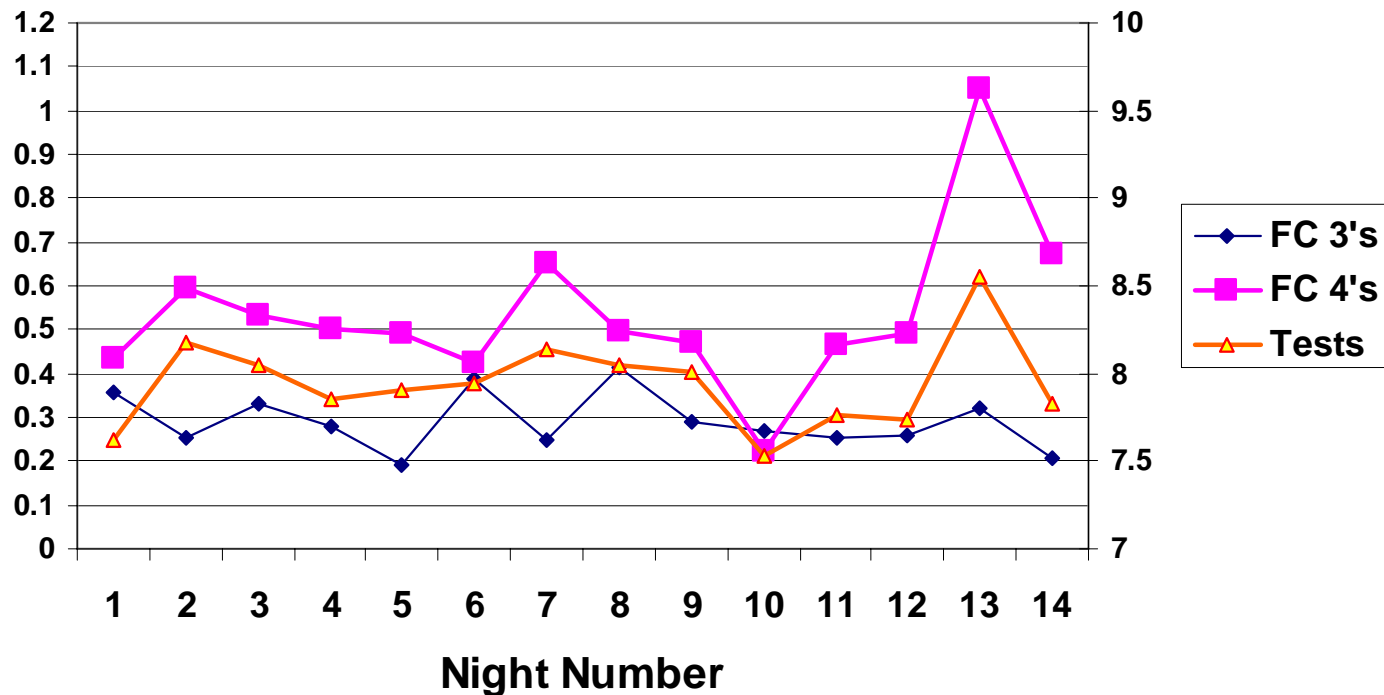


Length of Shift Performance & Circadian Influence - Night 14

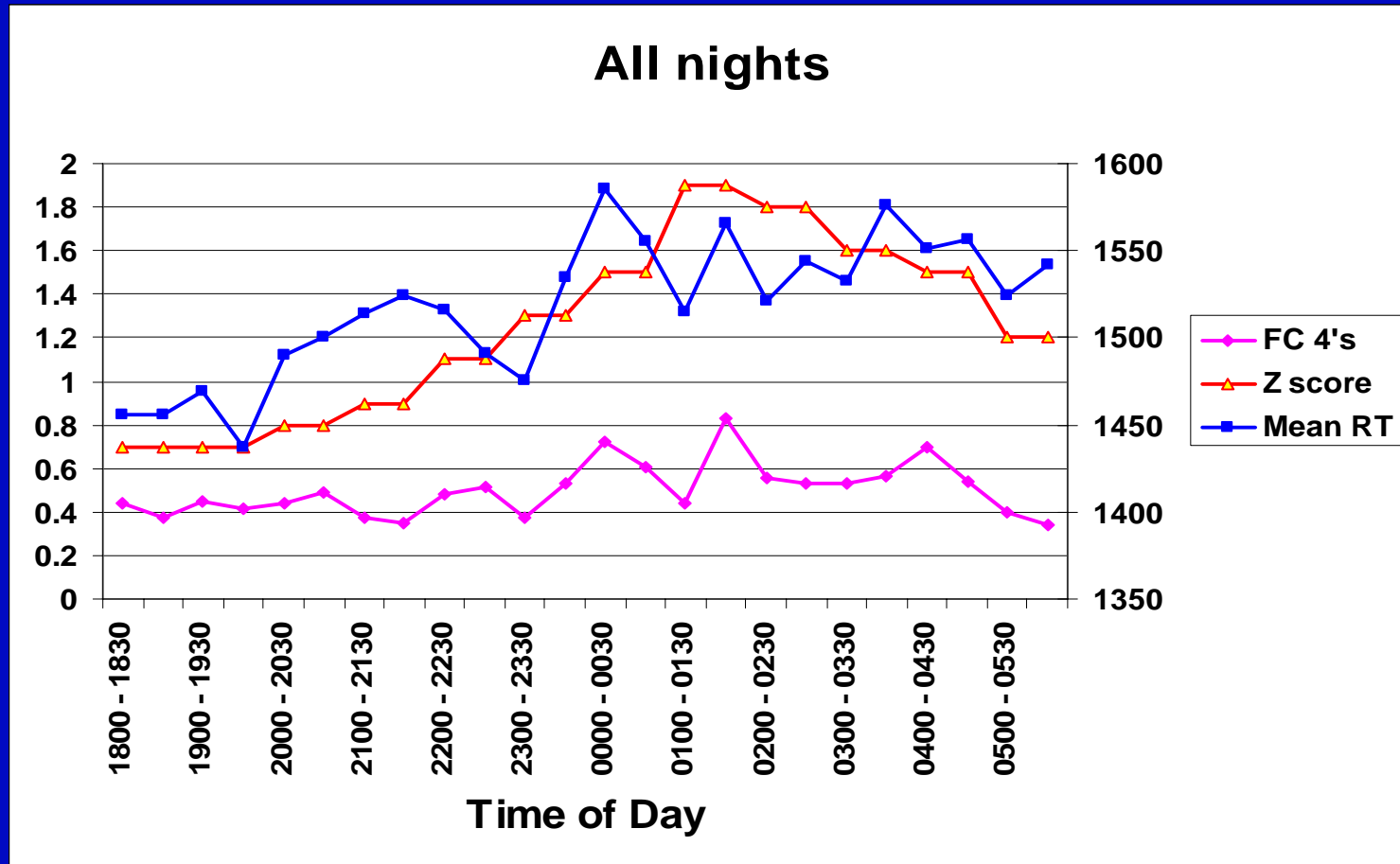


Nightshifts in Succession?

Night Shift - Average Tests per hour

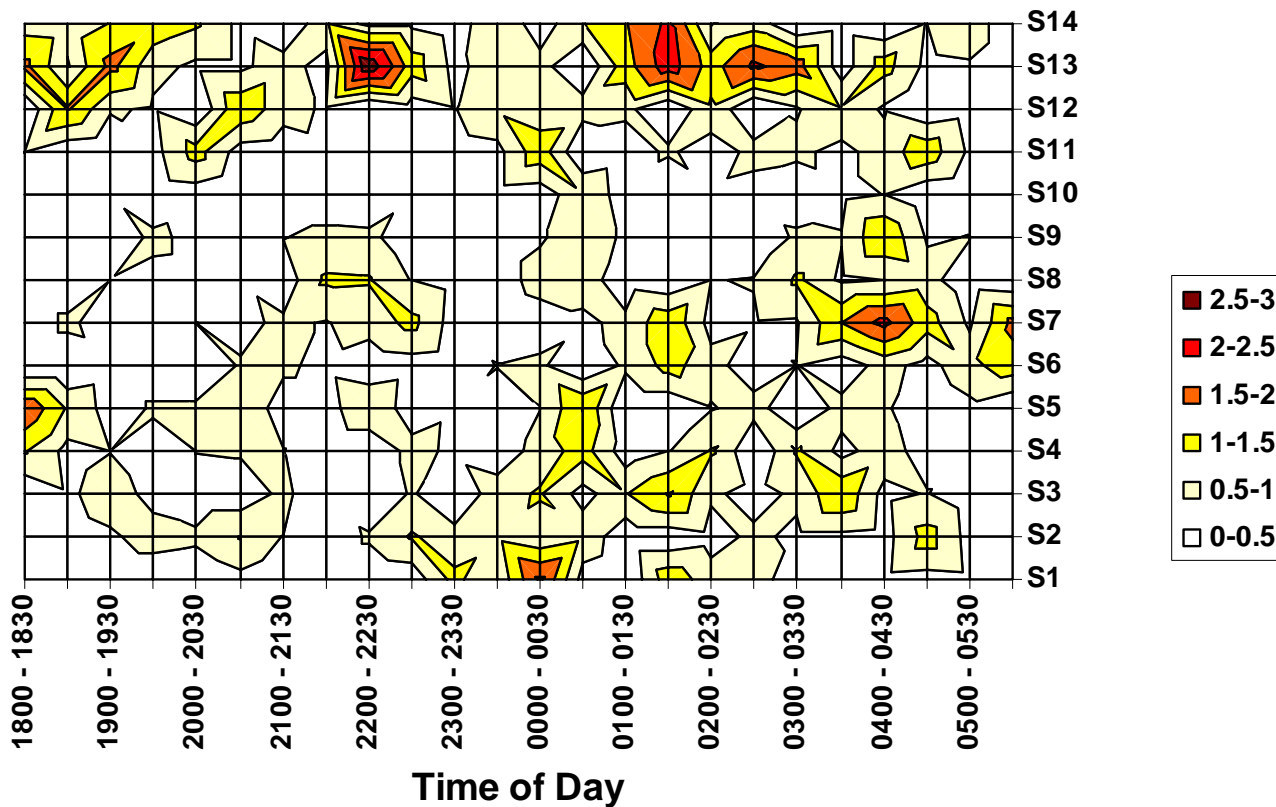


Circadian Effects



Length of Night Shift Performance & Circadian Influence

Nights 1 - 14 - FC 4's per hour

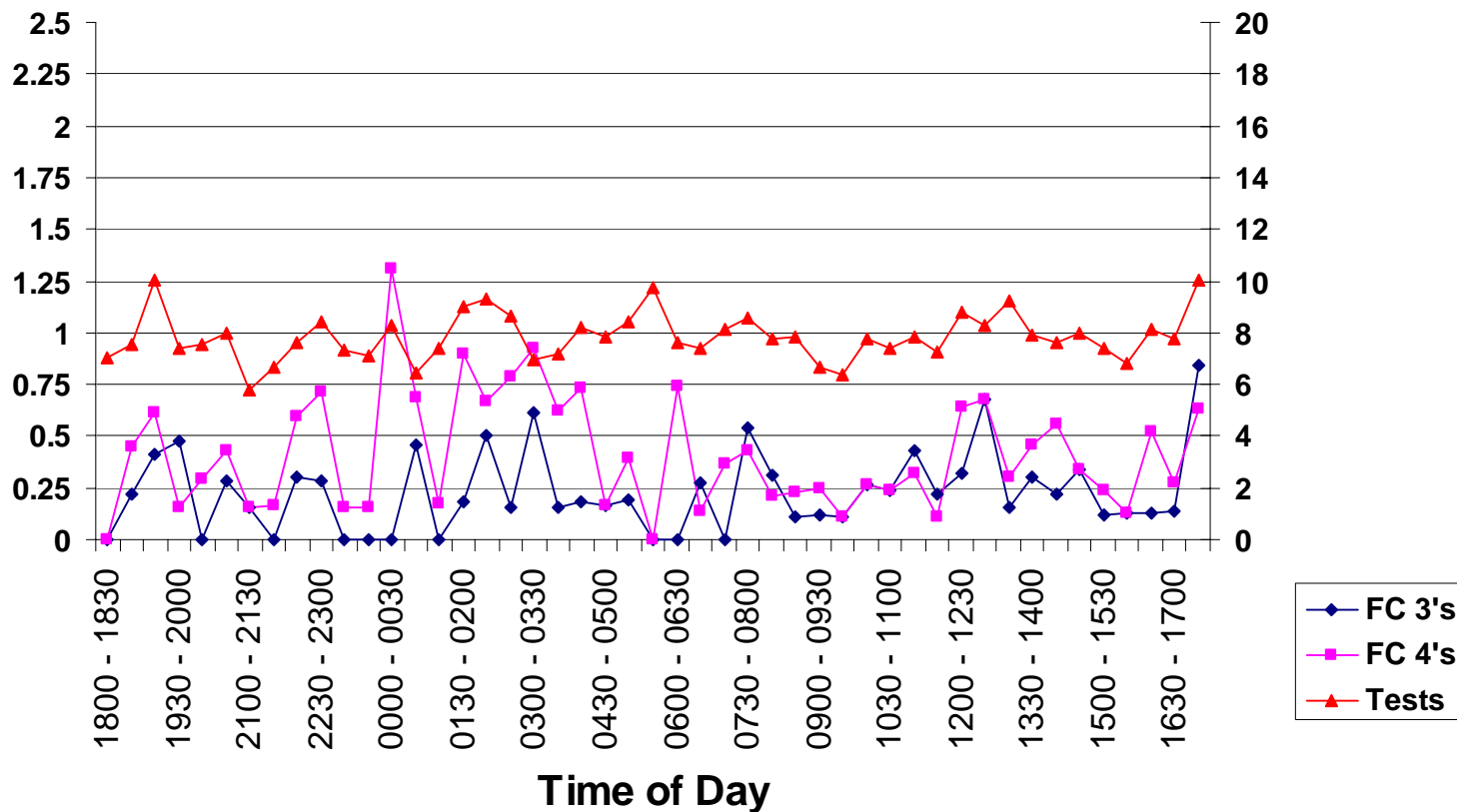


2 What is the limit of successive night shifts before chronic fatigue affects operator performance in open cut mines?

- **Any takers?**
- **Data suggests that some nights are worse (performance-wise) than other nights 2, 7, 13 & 14**
- **Sunday & Tuesday nights are bad**
- **Circadian effects present**
- **Hard to determine cut-off point as night 2 & 7 are worse than all <12**

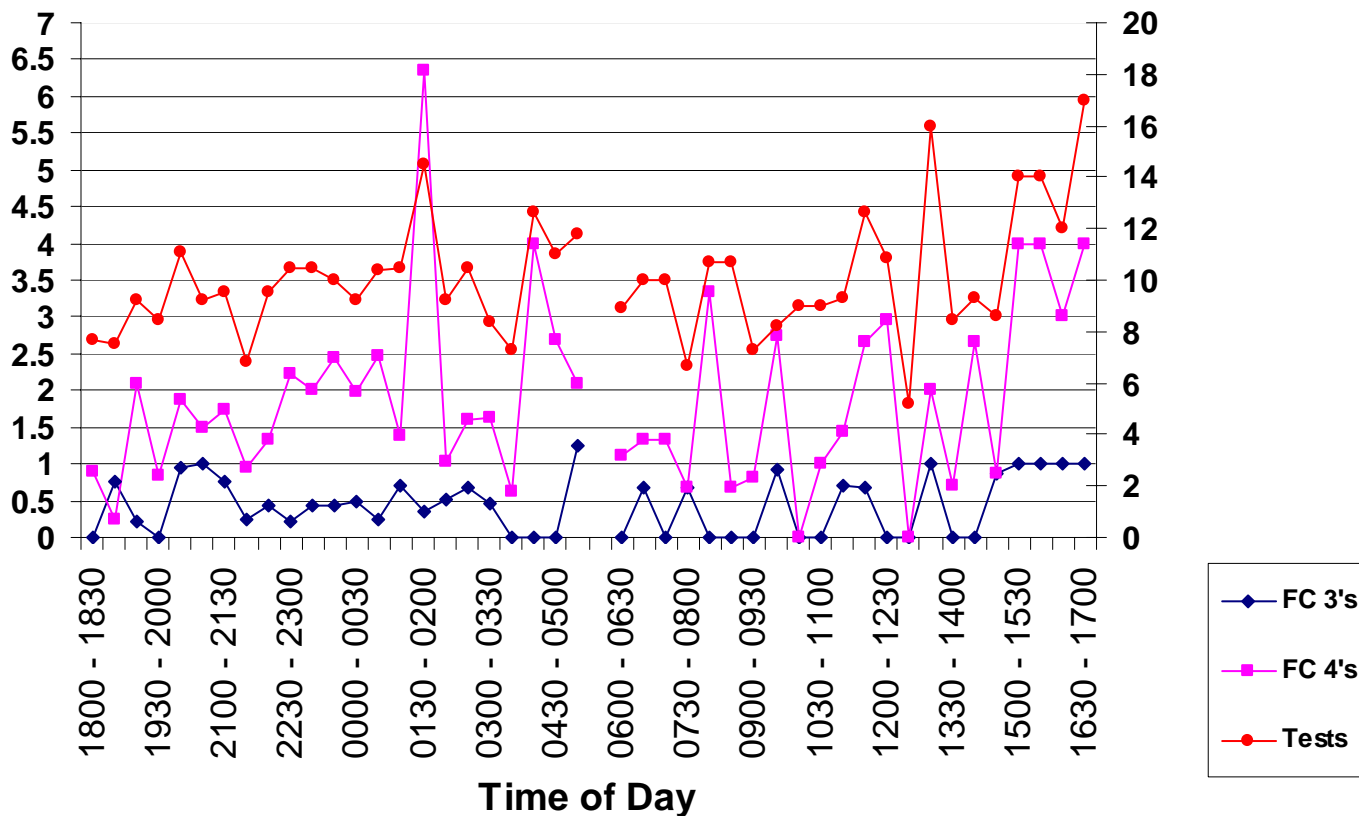
Individual Variability

Operator A - Tests per hour

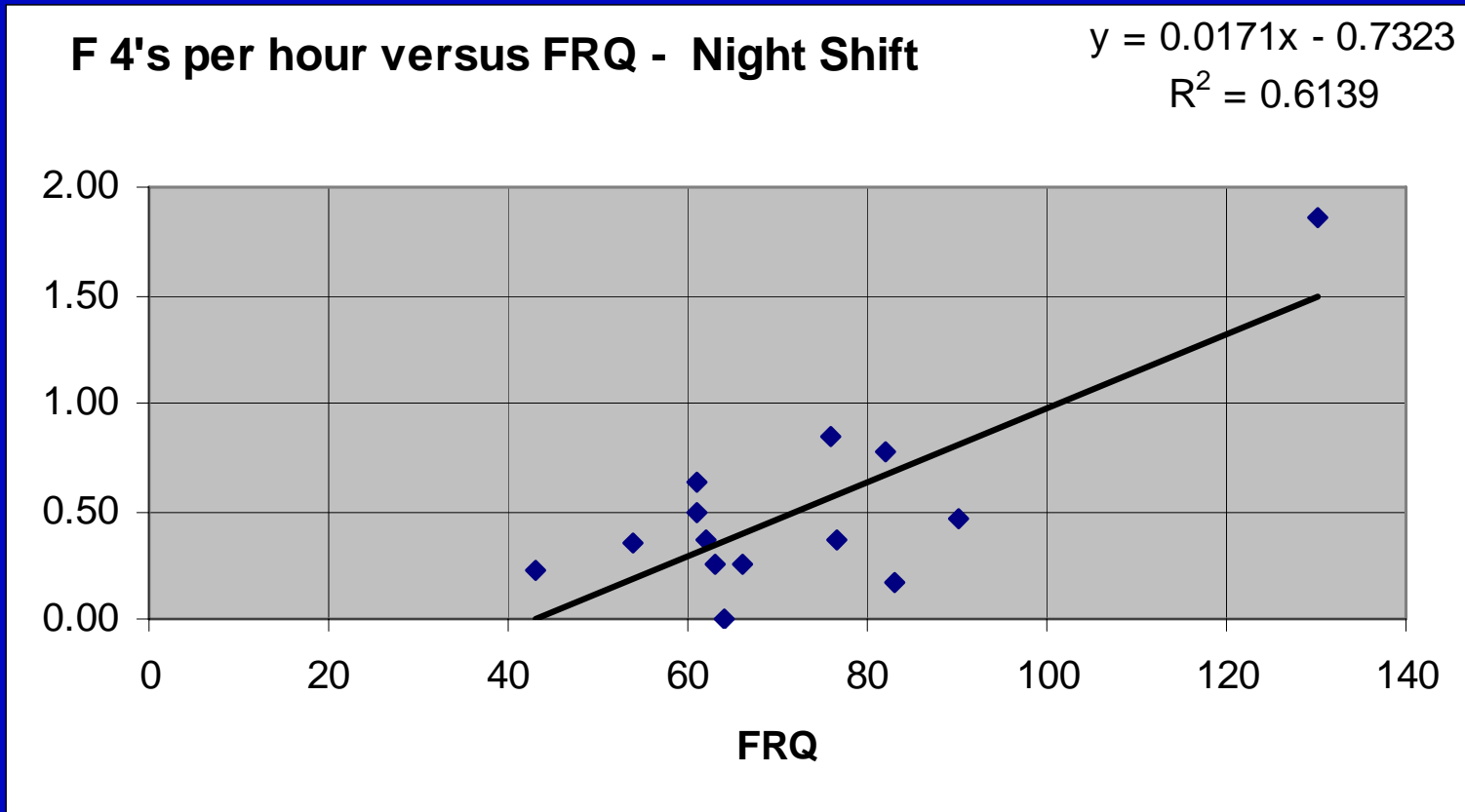


Individual Variability

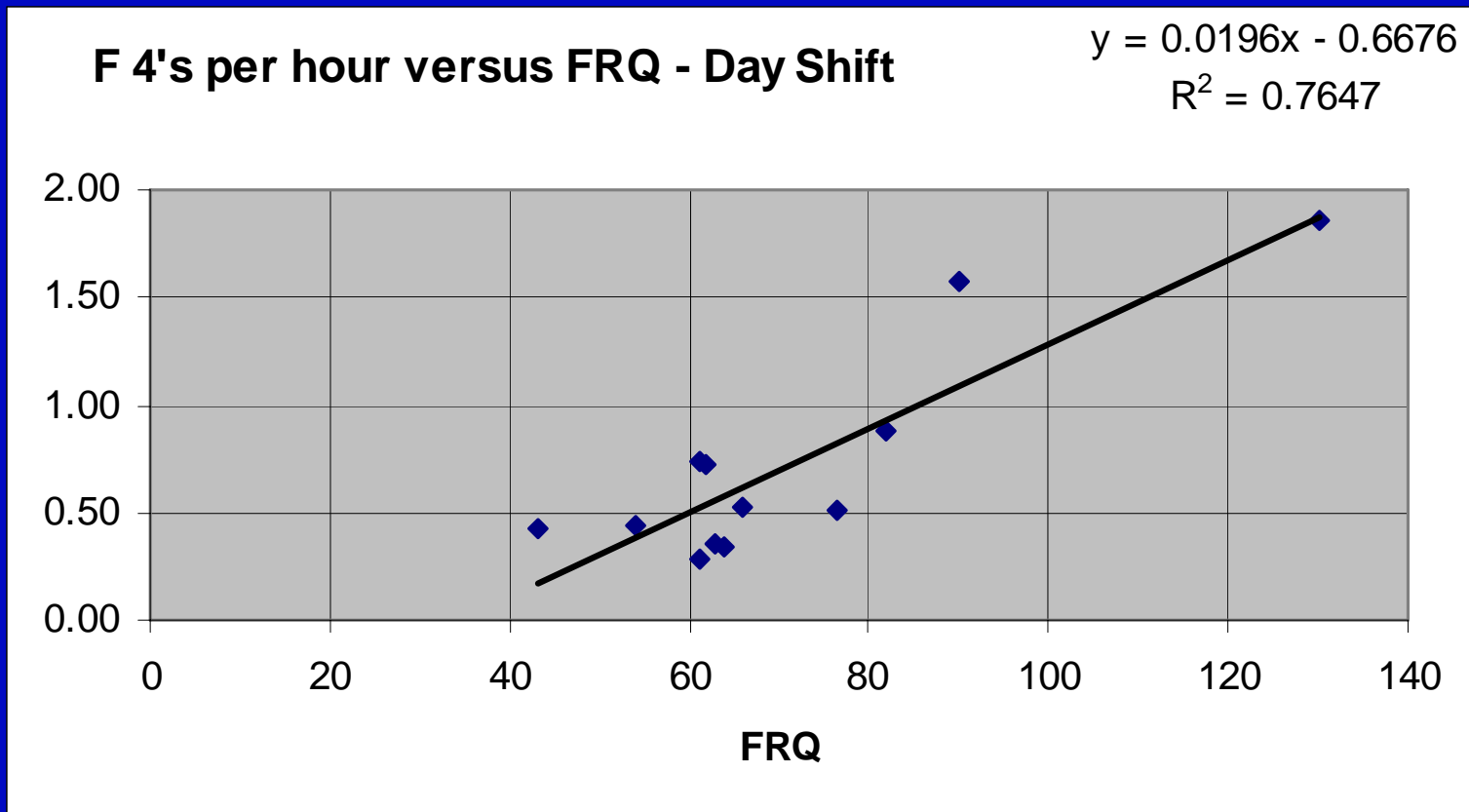
Operator B - Tests per hour



FRQ Score Correlation with Tests Per Hour



FRQ Score Correlation with F 4



What should we do about this?

- **Direct more attention to individual selection (53% obese).**
- **Observe patterns of high and low performance and try different countermeasures.**
- **Promote a culture where your drivers are willing to admit they are tired & in need of a break.**

More to Come...

- Data will be built up more over time - will be able to test rosters against each other for performance.
- Results may change the way we discuss what is best for operators (eg. FRQ and a higher individual focus).

Many Thanks

- Coal Services
- Sons of Gwalia
- MacMahons
- Personnel at Carosue Dam
- Bob Lloyd - ARRB

**Wednesday afternoon - Presentation of
PFMS**



QUEENSLAND MINING INDUSTRY Health & Safety CONFERENCE 2003

Accepting the Challenge

12.30-1.30pm

Lunch

Sponsored by

