URANGAN STATE HIGH SCHOOL (School Number: 371)

YEAR 12 – PHYSICS (2007 Syllabus)

Semester 3, 2017

TRAFFIC CONTROL EVALUATION ERT

Motor Vehicle Speed and Safety

Name: _____ **Teacher:** Mr Swann / Mr Whyborn **Date:** _____

Assessment Instrument Conditions

Semester:	3	**Unit:**	6	**Context**:	Motor Vehicle Speed and Safety
Instrument Nº:	7	**Type:**	ERT	**Duration**:	4 Weeks

ASSESSMENT TYPE		**GENERAL OBJECTIVES COVERED**	
Extended Response Task	✓	Knowledge and Conceptual Understanding	✓
Supervised Assessment		Investigative Processes	✓
Extended Experimental Investigation		Evaluating and Concluding	✓

ASSESSMENT CONDITIONS			
Supervised Exam	No	Open Book (Notes allowed)	Yes
Class Time Used	Yes	Student's Own Time	Yes
Teacher Input	Yes	Library Resources	Yes
		ICT Resources	Yes

TIME ALLOCATION

- **4** Weeks
- Approx. 2 hours class time allocated
- Approx. 10 hours personal time expected

PROFILE ENTRY		
Knowledge and Conceptual Understanding	**Investigating Physics**	**Evaluating and Concluding**

MOTOR VEHICLE SPEED & SAFETY – TRAFFIC CONTROL EVALUATION

INTRODUCTION

Roundabouts and chicanes can be an effective and safe method for controlling traffic flow, but some are better than others. The effect of roundabout design on the efficiency and safety of traffic flow is enormous. The design of a roundabout requires understanding of principles of Physics (forces and motion) but also needs to take into account environmental conditions and local traffic flow requirements. An effective roundabout for a busy commercial district will be inappropriate for a major connecting road where high traffic speeds are desirable.

Is there such a thing as a bad roundabout? If so, what features make one roundabout better than another, and are any of the following roundabouts particularly good or bad?

This task has two main foci: Developing an overview of various techniques used for traffic management and traffic calming, and the evaluation and comparison of roundabouts in various situations.

TASK DETAILS

Introduction

Produce an overview of some traffic management/calming techniques that are currently in use. In your overview, include a BRIEF outline of how it calms or controls traffic. (You should focus on the **physics** theory in this outline, but you can also briefly discuss other aspects such as psychological aspects.)

Principles of Physics

Describe the principles of physics that relate to vehicles safely negotiating bends such as roundabouts and chicanes, and the effects of various road surfaces (and contaminants) and roundabout dimensions or shapes.

Analysis and Evaluation

Some stimulus material in the form of satellite photos of various roundabouts and chicanes are provided (compliments of Google Earth). Using this material and data obtained from your research, analyse relevant vehicle motion **in a variety of conditions** and evaluate/compare each of the devices. (You may choose others if you wish – please check with me for suitability).

Conclusion

Consider the results of your analysis in terms of both safety and efficiency of traffic flow. Make recommendations regarding the important features that need to be included *and avoided* in good roundabout design. Finally, make a **justified** decision on which of the provided roundabouts is best suited to its location.

Some Useful Links – These are a good starting point!

TrafficCalming.org, http://www.trafficcalming.org/index.html
Traffic Calming 101, http://www.pps.org/info/placemakingtools/casesforplaces/livememtraffic

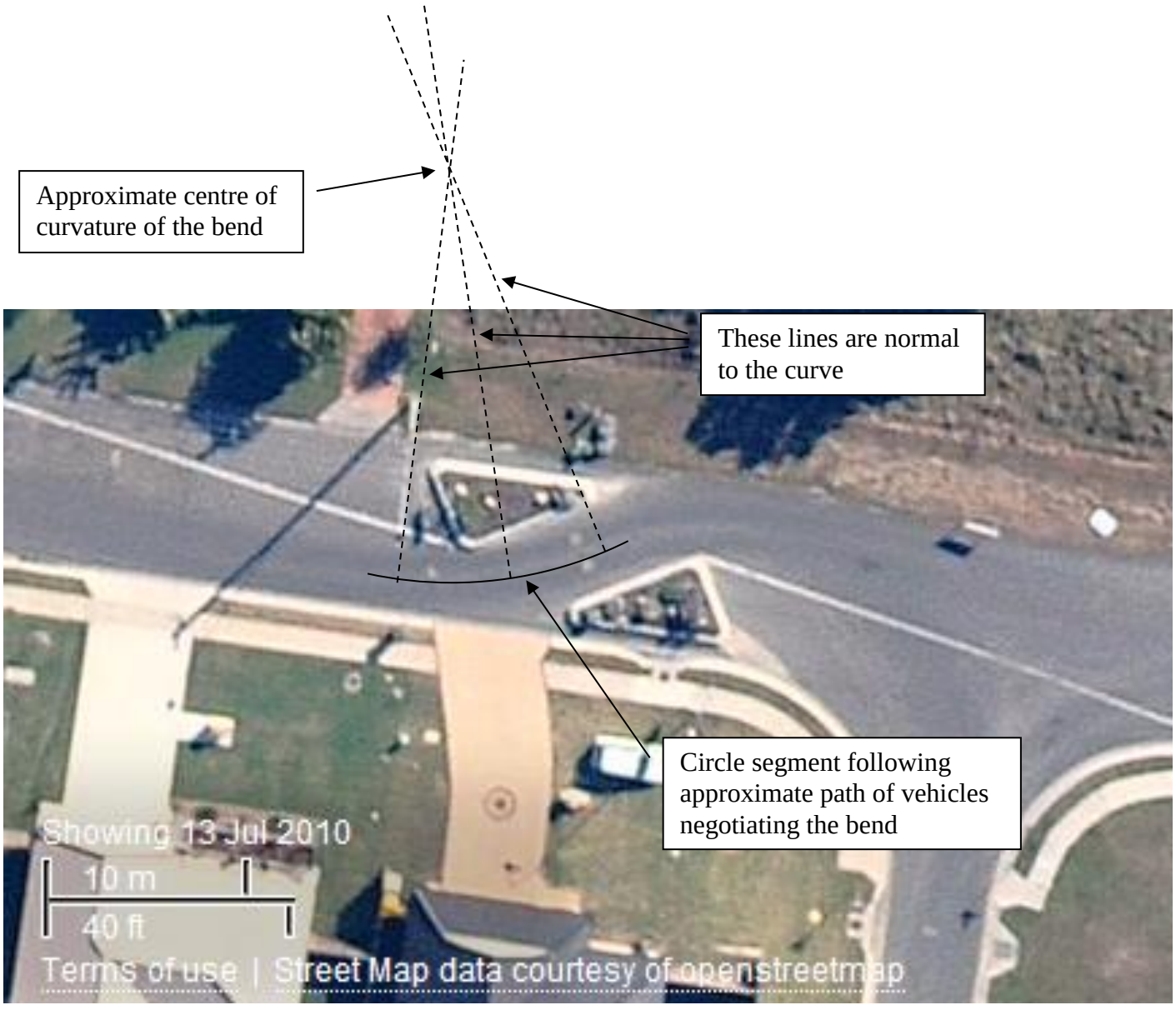
You will also be required to carry out research to locate appropriate data necessary for your analysis. Any constants or data used MUST be correctly referenced.

You ***might*** find it useful to look in more detail at the context/surrounding of the roundabouts. You should also consider the various possible paths that a vehicle might follow in negotiating a roundabout. Good resolution images can be found at maps.google.com.au. You may choose to print one of these to estimate radius of the path taken by the vehicles.

Stimulus 1: Traffic calming device on Samarai Drive, Kawungan

Note how the centre of curvature of a bend can be estimated by creating two or more lines perpendicular to the bend to find their intersection point.
Is the maximum speed without sliding a major design influence on this device?
Is it the same in both directions?

(***Note:*** *this structure has since been removed*)



Stimulus 2: Roundabout at intersection of Main Street and Boat Harbour Drive. Region speed limit = 60 km h^{-1}.

The camber (more correctly termed “superelevation”) on this roundabout varies considerably due to the surrounding terrain and services under/around it. What effect does this have on a vehicle negotiating the roundabout? (At the steepest section of the roundabout, the outside edge of the roundabout roadway is about 600 mm lower than the inside edge of the roadway.)

Stimulus 3: Roundabout on Boat Harbour Drive between Nissen Street and Old Maryborough Road.

This is on a straight stretch of a main road that has several industrial and commercial access points. Region speed limit = 60 km h^{-1}.

Stimulus 4: Roundabout at Hervey Bay-Maryborough Rd and Booral Rd (right) and Torbanlea Rd (left).

Speed limit on these roads is 100 km h^{-1} but reduces to 80 km h^{-1} approaching the roundabout.

Stimulus 5: A roundabout in Canberra – a city with a reputation for roundabouts. It is at the intersection of Yamba Drive (bottom right), Melrose Drive (bottom left) and Yarra Glen.

Yamba Drive and Yarra Glen are major arterial roads for the city. Melrose Drive is a major access road to commercial/shopping precinct and a residential area. Speed limit is 80 km h^{-1} on Yamba Drive and Yarra Glen and 60 km h^{-1} on Melrose Drive but increases to 80 km h^{-1} before reaching the roundabout.

If you are aware of any other particularly good or bad examples of roundabouts or other traffic calming examples, you may include them in your analysis. In this case, a print-out of the roundabout/device with a brief description of its context should accompany your report. HOWEVER, doing so will be disadvantageous if it does nothing more than existing examples to illustrate and reinforce your conclusions.

Motor Vehicle Speed and Safety Traffic Control ERT Criteria Sheet – shaded areas indicate criteria that DO NOT apply to the task

Crit	A	B	C	D	E
Knowledge and conceptual understanding	***These criteria are addressed mainly through the application of principles of physics to analyse and determine velocities through the roundabouts under a variety of conditions***				
	reproduction and interpretation of complex and challenging concepts, theories and principles relating to motion and forces.	reproduction and interpretation of complex or challenging concepts, theories and principles relating to motion and forces.	reproduction of concepts, theories and principles relating to motion and forces	reproduction of simple ideas and concepts relating to motion and forces	reproduction of isolated facts relating to motion and forces
	comparison and explanation of complex concepts, processes and phenomena related to the interactions between traffic and road structures.	comparison and explanation of concepts, processes and phenomena	explanation of simple processes and phenomena	description of simple processes and phenomena	recognition of isolated simple phenomena
	linking and application of algorithms, concepts, principles and theories to find solutions in complex and challenging situations.	linking and application of algorithms, concepts, principles and theories to find solutions in complex or challenging situations.	application of algorithms, principles, and theories to find solutions in simple situations.	application of algorithms, principles, theories and schema.	application of simple given algorithms.
Investigative processes	formulation of justified significant questions/hypotheses which inform effective and efficient design, refinement and management of investigations	formulation of justified questions/hypotheses which inform design and management of investigations	formulation of questions and hypotheses to select and manage investigations	implementation of given investigations	guided use of given procedures
	assessment of risk, safe selection and adaptation of equipment, and appropriate application of technology to gather, record and process valid data	assessment of risk, safe selection of equipment, and appropriate application of technology to gather, record and process data	assessment of risk, safe selection of equipment, and appropriate application of technology to gather and record data	safe use of equipment and technology to gather and record data	safe directed use of equipment to gather data
	This criterion is addressed mainly through the collection of relevant data required to create predictions, analysis of results of calculations and application of these results to the context of the roundabout				
	systematic analysis of primary and secondary data to identify relationships between patterns, trends and anomalies.	analysis of primary and secondary data to identify patterns, trends, errors and anomalies.	analysis of primary and secondary data to identify obvious patterns, trends, errors and anomalies.	identification of obvious patterns and errors.	recording of data.
Evaluating and concluding	***This criterion is addressed mainly through the analysis of results of calculations and application of these results to the context of the roundabout, identifying, describing, and evaluating the significance of various factors that relate to motion of vehicles***				
	analysis and evaluation of complex scientific interrelationships	analysis of complex scientific interrelationships	description of scientific interrelationships	identification of simple scientific interrelationships	identification of obvious scientific interrelationships
	This criterion is addressed through evaluation of traffic movement through the roundabout under a variety of conditions – investigating the effect of conditions and vehicle paths and drawing well considered and justified conclusions under a variety of conditions.				
	exploration of scenarios and possible outcomes with justification of conclusions/ recommendations	explanation of scenarios and possible outcomes with discussion of conclusions/ recommendations	description of scenarios and possible outcomes with statements of conclusion/ recommendation	identification of scenarios or possible outcomes	statements about outcomes
	This criterion is addressed primarily in the organisation and presentation of ideas, clarity of expression and precise and concise use of technical language, discriminating use of tables and graphs where relevant in order to illustrate and reinforce statements being made, ideas being expressed, and conclusions being drawn.				
	discriminating selection, use and presentation of scientific data and ideas to make meaning accessible to intended audiences through innovative use of range of formats.	selection, use and presentation of scientific data and ideas to make meaning accessible to intended audiences in range of formats.	selection, use and presentation of scientific data and ideas to make meaning accessible in range of formats.	presentation of scientific data or ideas in range of formats.	presentation of scientific data or ideas.