

Office of Geographic  
Data Co-ordination

*A report  
for*  
**Office of Geographic  
Data Co-ordination**  
*by*  
**FDF Management**

# Pricing principles for digital geographic data

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# Summary

FDF Management were briefed to identify appropriate pricing principles for the spatial data of the Office of Geographic Data Coordination. This report reviews the current status of the OGDC's spatial data, and the perceptions of current stakeholders in the Victorian market for spatial data.

The OGDC's three major types of data will soon reach a stage where broader marketing and promotion are appropriate. Clear pricing principles are needed to clarify the pricing policies for their expanding demand.

It is in the nature of spatial data that a variety of marketable products can be constructed at little extra cost from the same basic data.

International experience of pricing principles for spatial data is reviewed, and examples from other countries and administrations are summarised.

No single pricing principle has yet proved to be entirely satisfactory, and there is still wide disagreement as to the principles on which any pricing policies should be based.

Public and private sectors will benefit most if there is wide use of a single, coordinated set of data products.

The pricing principle that best supports this objective was found to be Ramsey pricing. Ramsey pricing recognises the following two key requirements: (1) that widest distribution of the product gives most benefit to society, and (2) that the producer of the information must achieve an appropriate financial return.

FDF Management have constructed two computerised models for determining Ramsey prices. One model handles a single data product, and assists in understanding the characteristics of Ramsey pricing. The other model addresses the pricing of products derived from a base data set (the State Digital Road Network).

FDF Management recommends that the Ramsey pricing method be adopted as the basic pricing principle.

Some of the concepts in this report may be new to the parties who are affected by them and whose cooperation is needed if the report's recommendations are to be implemented. We therefore recommend that the principles be discussed at a workshop conducted by a body such as Monash University's Centre for GIS.

Further steps to ensure effective policy development are:

- to run a public workshop for stakeholders on pricing principles, pricing strategy and market development;

- to consider legal protection through endorsement as 'current acceptable state of practice' by an expert client group;
- to review licence and royalty structures; and
- to develop marketing strategy by determining the product variants attractive to different market segments.

# Chapter 1

## Introduction

### 1.1 How the study came about

The Office of Geographic Data Coordination (OGDC) is responsible for coordinating the development, availability and distribution of Victoria's key spatial data. The OGDC has three main spatial data products in an advanced stage of development:

- the *State Digital Road Network* (SDRN): a spatial database of road centrelines,
- the cadastre: a spatial database of land parcel boundaries, and
- the 'topo'; a topographic digital terrain map.

As these products grow in coverage, currency and precision, they are becoming well established in the marketplace. However, 'To date there has not been an agreed approach to pricing... – agencies supply their own datasets and price them on an individual basis.' Progress has now reached a point where a review of pricing principles is required and a coherent, transparent and equitable set of pricing principles is needed.' Accordingly the OGDC has commissioned this study.

### 1.2 Study objectives

The aims of the study (*Brief*, page 1) are to

1. identify pricing concepts...;
2. examine [their] implications...;
3. demonstrate the effects of different pricing structures through simulations;
4. recommend a preferred pricing structure....

Further, the consultant is required to consider the following:

- Government should retain ownership...;
- data should be transferred under license;
- monopoly pricing is not appropriate;
- there is to be a standard license format...;
- royalties are to be returned to agencies;
- cross subsidisation...is contrary to government policy;
- 'public good' issues and Community Service Obligations.

### 1.3 Future directions

The devising of pricing principles could in our view constitute one stage in a process aimed at marketing OGDC data products in an orderly fashion as follows:

- Victorian GIS Data Committee selects a specific pricing principle;

- stakeholders participate in developing the pricing strategies, market segmentation and alliances that follow from this choice;
- the market is assessed to determine appropriate product packaging and market elasticities; and
- products and markets continue to be maintained and developed with the involvement of stakeholders.

This report addresses the first stage in the process, but also includes some recommendations relevant for later stages.

## 1.4 Approach and report structure

Our approach to the task has been to examine both the economic principles behind pricing decisions, and the characteristics and peculiarities of spatial data markets. From these two sources of information—one founded on theory, the other on empiricism—we synthesise conclusions and recommendations which reconcile theory with practice.

Our report is structured as follows.

- Chapter 2 *The economics of pricing decisions* describes the economic principles of pricing as they apply to the OGDC;
- Chapter 3 *Client perspectives* sets out the views of the OGDC's clients;
- Chapter 4 *Current experience* describes the marketing of electronic spatial data in Australia and overseas;
- Chapter 5 *Modelling* describes how we modelled pricing principles as they applied to the Emergency Services Network.
- Chapter 6 *Implementation* discusses how our recommendations—illustrated in chapter 5—could be implemented, and raises a number of issues and problems related to implementation;
- Chapter 7 *Conclusions* presents our conclusions and recommendations.

The study was carried out by

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- Andrew Edgar, Consultant, FDF Management.

## Chapter 2

# The economics of pricing

In this chapter we present the economic principles which guide our pricing recommendations, and we show how they shape those recommendations. We begin with a general discussion of the aims of pricing policy, and of the principles required to satisfy those aims. We then apply the principles to the OGDC in general, and the SDRN in particular.

### 2.1 Pricing objectives

Enterprises generally choose between two key objectives when setting prices. Either they seek to maximise profit, or they seek to maximise net benefit to society – ‘net social benefit’ (‘social welfare’ in the terminology of economics). Private enterprises mainly seek the former – to maximise profit – and do so by setting price such that marginal revenue equals marginal cost (that is, such that the revenue from the last unit sold equals the cost of the last unit sold). Public enterprises such as the OGDC *ought* to seek to maximise net social benefit; and this they can do by a procedure known as Ramsey pricing.

Of course, the two objectives may sometimes be one and the same. This explains why profit maximisation may, under the highly restrictive assumptions of ‘perfect competition’, also lead to the maximisation of net social benefit. Similarly, the maximisation of net social benefit may masquerade as profit maximisation if the same highly restrictive assumptions apply. However, the assumptions of perfect competition – which would be required to make maximisation of net social benefit coincide with profit maximisation – emphatically do not apply to the OGDC. Hence the OGDC faces a choice: to maximise profit<sup>1</sup>, which entails a high price; or, by charging different prices, to maximise net social benefit.

In this study we recommend that the OGDC maximise net social benefit because this is the only legitimate goal of a public enterprise. We furthermore show that in the OGDC’s case, maximisation of net social benefit does not coincide with profit maximisation, because the assumptions under which this would be so do not apply. We then describe the rules for maximising net social benefit, and show how they apply to the OGDC.

### 2.2 Pricing regimes

The OGDC can in principle choose between several pricing regimes, each of which achieves different objectives.

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<sup>1</sup> Although monopoly pricing is explicitly ruled out by the *Brief*, we discuss it in order to compare and contrast pricing regimes.

**Monopoly pricing** (also called ‘profit maximisation’) is implemented by pricing in such a way that marginal revenue equals marginal cost. This pricing option will maximise the OGDC’s profit but is unlikely to maximise net social benefit. Monopoly pricing is possible in any market which is less than perfect, which means most markets, including those in which the OGDC operates.

**Marginal cost pricing** (also called ‘social welfare maximisation’) is implemented by setting price equal to marginal cost. Marginal cost pricing maximises net social benefit of the OGDC’s products, but because the OGDC would have to be subsidised as a result, marginal cost pricing would reduce the benefit to society elsewhere in the economy. Hence marginal cost pricing is unlikely to maximise net social benefit overall.

**Average cost pricing** (also called ‘full cost recovery’) is implemented by setting price equal to average cost. This pricing option will ensure that the OGDC’s costs (including an appropriate return on capital) are covered. Because the OGDC’s average cost is greater than its marginal cost, average cost pricing reduces the net social benefit of the OGDC’s products. But because it requires no subsidy, it does not diminish the benefit to society elsewhere in the economy. Hence it could maximise net social benefit overall, and is in any case likely to achieve a better result than marginal cost pricing.

**Ramsey pricing** (also called ‘constrained social welfare maximisation’) is implemented by setting price such that net social benefit is maximised subject to the constraint that the OGDC’s costs (including an appropriate return on capital) be covered. For the single-product enterprise, Ramsey pricing is normally operationally the same as average cost pricing. However, for a multiproduct enterprise such as the OGDC, where average costs cannot be identified because of joint costs, Ramsey pricing provides a pricing regime which does not rely on the concept of average cost (see appendix D).

## 2.3 Pricing problems and issues

In this section we discuss pricing issues, and show how we deal with them (table 2.1).

**Table 2.1**  
*Potential problems with pricing regimes*

Nature of issue	Monopoly pricing	Marginal cost pricing	Average cost pricing	Ramsey pricing
Historical costs			Not if valued at replacement cost	Not if valued at replacement cost
Joint costs			●	
Monopoly power		●		
Continuously declining average cost		●		
Uncertainty of demand elasticity	●			Only if Ramsey price is sensitive
Inelastic demand	●			
Small marginal cost		Apparent only		Apparent only
Community service obligations	●			

***Historical costs***

The OGDC exists because an enormous investment has been made over the years in Victorian spatial data. To what extent should these historical costs be taken into account in any pricing policy? For marginal cost pricing (which sets price equal to marginal cost) and for monopoly pricing (in which price is set such that marginal revenue equals marginal cost) the issue does not arise, since historical costs by definition do not contribute to marginal cost. But for Ramsey pricing (which includes average cost pricing as a special case) the issue is a real one.

Historical costs ought to be taken into account in Ramsey pricing provided they are valued at replacement cost (which may exceed, but will typically be less than, historical cost). Historical costs should only be disregarded—that is, treated as sunk—if demand conditions are such that it is impossible to price at average cost. In that case, price should be reduced towards marginal cost, though never below it. Current replacement cost is the appropriate valuation for historical assets because it results in a price which will not permit a competitor profitably to undercut the OGDC and so displace it from the market.

***Joint costs***

The OGDC produces three main products, and may produce more in the future. But many of its costs are joint in the sense that they cannot be rationally allocated to any single product. They include such items as general management overheads, quality control, contract management, distribution setup, marketing and operations (and, indeed, the cost of this consultancy). How are such costs to be dealt with in setting prices?

Since joint costs, like historical costs, are by definition not marginal, they do not affect monopoly pricing and marginal cost pricing. Nor do they affect Ramsey pricing because Ramsey pricing requires only that we know total cost, not average cost. (Although average cost pricing *is* affected, it is itself a special case of Ramsey pricing. However, it only applies to the single-product enterprise, where, by definition, there are no joint costs.)

***Monopoly power***

Does the OGDC possess monopoly power? If so, how can it be prevented from exercising it to the detriment of society? Some OGDC products are contestable: the SDRN for example. For this product at least, the OGDC’s monopoly power is limited, though still substantial due to the still-large fixed capital investment required of any new entrant. But other products, preeminently the combination of the cadastre and titles information, are not yet contestable.

Some OGDC clients have argued that the OGDC should be given more legal power to require data to be provided to them and to ensure that their data are used. Although this would appear to grant the OGDC a degree of monopoly power, that power could be controlled by requiring the OGDC to employ Ramsey pricing. This would prevent its raising prices to such an extent that the benefit to society is diminished.

***Continuously declining average cost***

Because the OGDC’s fixed costs are high, and its marginal costs small and constant, it faces a continuously declining average cost. This means that marginal cost is always and

everywhere below average cost (we assume away the joint cost problem for the moment). This means that marginal cost pricing is bound to cause the OGDC to incur an accounting loss (even though net social benefit might be enhanced). How should this loss be covered?

Ramsey pricing is designed to overcome exactly this problem. The Ramsey price is by definition that which maximises net social benefit. Normally this means that the enterprise prices in such a way as to cover its costs, which in the single-product case entails pricing at average cost. Ramsey pricing can be consistent with receipt of a government subsidy by the enterprise, but only if to do so is socially optimal (see section 2.5).

***Uncertainty of demand elasticity***

Little is known about the price elasticities of demand for the OGDC’s products – that is, little is known about their responsiveness to changes in price. Yet in order to set a Ramsey price we must know the price elasticity of demand of the product in question. How are we to estimate elasticities, or alternatively compensate for this lack of knowledge?

It is possible that the Ramsey price for the SDRN is insensitive to elasticity within its likely range. However, even if it is not, we point out that Ramsey pricing is not alone in its dependence on price elasticity of demand. In order to apply any of the pricing regimes discussed in this report one needs to know price elasticity. Lack of knowledge of price elasticity cannot therefore be an argument for one pricing regime rather than another. (See appendix D for details.)

***Inelastic demand***

Although demand for the OGDC’s products is uncertain, we believe that demand for some products in some markets is inelastic – that is, relatively unresponsive to changes in price. A consequence of this is that marginal revenue is negative. If this applies at all levels of demand, then monopoly pricing, which requires that marginal cost equal marginal revenue, is undefined. The rational profit maximiser will never price where marginal revenue is negative since revenue can be increased by raising price.

This is of course an artifact of our assumptions about demand, namely that elasticity is constant: in practice demand always becomes elastic if the price is high enough, if only because consumers would otherwise run out of money. Nevertheless in practical terms it means that we are unable accurately to estimate the profit maximising price for certain products, should we wish to do so. In such circumstances an unregulated monopolist would raise prices until marginal revenue were positive and equal to marginal cost, as eventually it would be. If necessary, the monopolist would arrive at this point by trial and error. All that we can say is that such a price would be extremely high, since we cannot be guided by trial and error. However, the fact is that one would not allow the OGDC to price in this way, so the issue is of theoretical concern only.

***Low marginal cost***

Because information generally costs little to disseminate, its marginal cost can be small. This naturally affects the Ramsey price, and other pricing policies as well; and means that the quantity ‘sold’ is sensitive to small changes in marginal cost. Since marginal cost is

uncertain, this means that we cannot predict sales with any accuracy. Does this matter? No. When marginal cost and marginal revenue are small, large differences in sales make little difference to net social benefit, which is, after all, what really counts.

Only the direct costs of making data available to end users is counted as marginal. Such costs comprise the fixed costs of production in the form of transportable media (which could be physical such as CD-ROM, or intangible such as direct network access), and the variable costs of transfer. For CD-ROM this would comprise mailing, mastering, manufacturing and copying costs. However, if CD-ROMs were routinely created as a monthly backup then the cost of producing a master would not be included; only the costs of burning a fresh copy or copying to some other medium. For intangible formats delivered through a network access, marginal costs are essentially zero to the supplier as the user bears the communications costs of any transfer. If there were several different delivery formats, then there would in principle be several different marginal costs to match.

***Community service obligations***

Community service obligations (CSOs) are activities paid for by government in the community interest that would not have been paid for within the organisation under commercial guidelines. CSOs are goods with positive externalities: a good is a CSO if society deems that the net benefit it provides to society (including the consumer) is insufficiently valued by the consumer. Such goods would, if left to the untrammelled market, be consumed suboptimally. Sometimes termed ‘merit goods’ by economists, they are normally provided free (sometimes compulsorily, as in the case of education) or subsidised. CSOs are defined by the Victorian Government (Office of State Owned Enterprises, 1994) as goods or services which satisfy the following criteria:

- the CSO is provided for some identifiable community or social benefit;
- the CSO is the result of a specific government directive to a government business regarding the provision of the CSO and the conditions (eg. price) of its supply; and,
- the CSO would not be supplied, or would not be supplied on the same conditions by the government business enterprise, if it were acting primarily in its own commercial interest. Instances of ‘good corporate citizenship’, such as sponsorship, are not included as CSOs.

Does the OGDC have any CSOs by this definition, and if so, what are they and how should they be allowed for in pricing decisions?

Since the OGDC has a specific directive to provide the SDRN to BEST at no charge, this is a CSO under these specifications. There can be little doubt that other spatial data do provide a great social benefit, but not necessarily more than clients are willing to pay for. They would therefore be supplied on the same conditions if the OGDC ‘were acting primarily in its own commercial interest’, hence do not fall under this CSO specification.

Government guidelines (Office of State Owned Enterprises, 1994) set out procedures for the costing, funding and monitoring of CSOs. These rules can be incorporated into the pricing regimes discussed in this report by characterising the funding of the CSO as a reduction in cost or as an increase in revenue (both methods produce the same results).

## 2.4 Non-price objectives

### *Spatial data clients*

Spatial data clients in general have objectives which may include:

- realising efficiency gains in their operations;
- reducing their internal costs on spatial data acquisition and quality assurance;
- realising benefits from the value they might add to the base OGDC data in terms of improved quality data;
- offering better services based on the combination of their own and OGDC data; and
- obtaining revenues from their own additional data, made the more marketable by being overlaid on a common (OGDC) spatial base.

### *Government*

Government non-price welfare objectives include:

- standardisation on a common spatial data framework for the key products;
- maximising public sector efficiency gains by use of common spatial data;
- lowering the barriers to entry for value-added private enterprise services and software;
- raising educational skills in spatial data handling and integration; and
- improving community communication and consultation through GIS data.

### *Education sector*

The education sector shares many of the above concerns, and has additional objectives:

- the ability to train and teach on live local spatial information;
- the ability to obtain research support for graduate students on projects involving spatial data; and
- obtaining consulting work requiring access to well organised spatial data to maintain close links with client communities in industry, commerce and government, and secure revenues for their own operation.

Priorities must be accorded to these objectives, although different combinations could be used in different market (or community) segments.

### *Private individuals*

Private individuals are now becoming interested in using government information in order to participate in the political process. The objectives of freedom of information and government accountability are no longer adequately served by access to written documents. Provision and access to key basic data are a reasonable expectation for increasing numbers of private individuals.

Pricing principles are closely linked to these objectives. Clearly market segmentation is highly desirable, as the objectives of government, commerce, industry, the education sec-

tor and individuals do not necessarily coincide. Dollar price alone is not the sole controllable aspect of the decision of the client to obtain a particular data product. A spatial data product such as a cadastre is not a single entity. It may be packaged in a number of ways, and priced accordingly. Depending on how such packaging is done the digital cadastre may attract different levels of interest and offer different levels of value to different groups of clients.

## 2.5 Other issues

### *Market segmentation*

Markets can be segmented to yield different price structures in different market segments such as educational (school, university), individual (profit/non profit), and corporate (commercial, government and non profit) clients. These are not the only forms of market segmentation that should be considered. Market segmentation can in principle be applied to all pricing regimes. It permits the OGDC to capture consumer surplus that would otherwise accrue to clients.

### *Data currency*

Spatial information products depend on their currency for much of their value. If a cadastral database does not contain changes which happened in the last two years, its value is less than if the information were only a month old. While currency is a key factor in the value of a spatial database, the rate at which its value declines depends on how rapidly information in the database changes and becomes out of date. If only one or two items in a database of 2 million items changes in a year, value is lost very slowly; if 10% of items change every year (as in the cadastre) value is lost rapidly, and hence the value of information currency is considerably higher. Each of the three major OGDC products is affected differently:

**The topo.** Physical terrain changes little, and once recorded with the required precision, the data are relatively easy to keep current. However, topographic data other than spot heights and contours may change rapidly. These include data relating to structures such as buildings, fences and so on. Moreover, all kinds of topographic data may be recorded with greater precision over time.

**The cadastre.** Legal boundaries change slowly, though faster than physical terrain. About 2% of land parcels and 10% of title owners change annually. Some other types of 'cadastral' information may also change rapidly. For instance, local government and administrative boundaries may alter, and informal district names, however useful, are often vague and subject to change.

**The SDRN.** The road network is constantly changing as routes are altered and new roads built. Road names are another source of difficulty, as multiple names are common. (As a result of the requirements of emergency services, the SDRN contains a valuable high-quality multiple naming facility.) There are also other layers of information, each subject to change. As the topological detail of the road system is improved, banned turns and other road attributes will make the process of updating more difficult.

***Data ownership***

The history of each of the OGDC databases is different, and many parties have contributed to their making. This is important when considering pricing principles because the rights of many parties to hold information of various types, and the historical investments of different groups in various aspects of the data, all add to the difficulty of establishing the actual total investment required to bring the current data products into being.

***'Reference products'***

The OGDC can and should (according to its mission) deliver economies of scale to the Victoria by providing a stable common base on which all spatial data in the State can build. But to do so, the OGDC must first define what products to provide. This is not straightforward, as each product may be developed to different levels of precision, coverage and currency; and each can be enhanced by adding further layers of information. A Government coordination body such as the OGDC is also suited to the dissemination of metadata and the legal endorsement of spatial databases as being the current 'state of the art'. This provides a level of insurable protection for users, which reduces barriers to entry for those wishing to offer services based on OGDC products.

To enable the OGDC to carry out these functions we propose the concept of a 'reference product'. A reference product is a combination of spatial items, layer definitions, accuracies at a given point in time. The process of creating such a product can be quality-assured under ISO 9000; but would still require regular re-endorsement by an OGDC client group if the product's current accuracy, procedures for error eradication, and foibles were to be understood and accepted. This endorsement would also include the levels of currency regarded as part of the standard reference product (usually annual).

There is a precedent for the concept of a reference product: the Victorian cadastre from a decade ago. Moreover the concept is consistent with the OGDC's responsibilities and mission. Accordingly the pricing principles in this report are based on the concept, as it offers the following advantages: higher levels (and values) of currency; progressive upgrades of what comprises a reference product over time; and a basis for clear legal and insurable protection for subsequent service providers.

## Chapter 3

# Client perspectives

OGDC clients were interviewed for their general views of the products, and for any licensing and pricing concerns. A concise digest of the major points made in these interviews is given as appendix A. Where they deal with the same subject matter, our results are broadly consistent with a previous RMIT (Towt and Arrowsmith 1995) pilot mailout survey.

### 3.1 Legal issues

Legal issues concerned some clients as much as pricing. Their concerns could, however, be assuaged if a broad community of data users were to 'sign off' each database as fit for the purposes intended.

A closely related matter is the manner in which the OGDC sells maintenance updates. The currency of a product affects its value: an on-line product is valued more than a bi-monthly upgrade, which in turn is valued more than an annual update. However, updates can be presented to the market in two different ways: as a form of quality assurance, or as a means of keeping the dataset current. Clients who perceive few differences between one update and the next will place a low value on having frequent updates. But those clients will be attracted if the same updates are sold as quality assurance. Thus a product's price depends on how it is presented. A data product which can be regarded as a defense against legal redress is qualitatively different from one which carries no such implicit guarantee.

### 3.2 Data format

Clients repeatedly expressed the view that the format in which OGDC data was delivered affected their internal costs. In several cases at least one of the standard ArcInfo, Intergraph or SDTS (Hume and Miller 1995) formats could not be accommodated readily and incurred additional costs for the client.

The precise physical and electronic format in which the data service was provided was also an important factor: provision of a complete new OGDC database required a full reload of the client system. For some clients this cost more in manpower and computer time than the data itself. Most clients prefer that data be provided in incremental form, so that only updated records need be loaded. The technical requirements to meet this need have to date only been covered within the SDRN road centreline product. The format of data delivery is clearly a pricing issue, as the friction incurred between purchase from the OGDC, and successful transfer to using the new data in-house, can be large.

### 3.3 Data quality

Quality was interpreted in different ways. Some clients sought completeness in coverage, and assurance that coverage was as complete as technically possible. Others were concerned at possible misalignment between OGDC spatial locations and administrative boundaries. For example, if a cadastral database is accurate to the specified level of +/- 5 metres, it might place a road in the 'wrong' administrative area if the road centre line defined the boundary. Such topological alignment details are of great importance to some client organisations, and in the longer term resolving such issues on the ground would be of considerable cumulative value, especially if coordinated with the OGDC through a continuing client group. As quality means different things to different clients, due to their varied needs and requirements, such a group could mediate such user priorities

Third-party Quality Assurance proved to be valuable in the rapid development of the SDRN to the current levels of accuracy in spatial connectivity and naming, and third party quality assurance and endorsement processes could provide a valuable—and valued—addition to the OGDC production and marketing process.

Quality is a key factor in the attribution of value to OGDC data by clients, and is addressed in the pricing simulation model only in terms of currency as the indicative quality variable. Market preference surveys would be valuable to address the utility to clients of other utility factors when packaging different product attribute bundles for sale. Segmenting markets by aspects or levels of quality of data provided (however defined) is a possible pricing strategy.

### 3.4 Licensing

The definition of a data 'product' is strongly influenced by the terms and conditions of data licensing. A greater variety of licensing models is needed to cater for the different needs of clients. The ability of clients to on-sell OGDC data integrated with their own—perhaps using a selective of version of the OGDC dataset they purchased—will determine the likelihood of client success in product sales in their turn.

The pricing unit used in current OGDC licenses also needs to be modified. Per-seat pricing does not accommodate the wide variation in usage between dedicated on-line use and the occasional queries by a senior manager. Floating licences for data are still difficult to implement and enforce; but a form of block pricing based on a notional (or actual) administrative unit for larger organisations (typically containing 30-50 people) priced at 3 to 5 times the price of a single unit, is a workable alternative that should be assessed. Access by senior management may be accommodated by defining the full senior management layer of an organisation as a notional department, and thereby cover the questions of wide variations in intensity of simultaneous use by very different types of licence users. These proposals provide a basis for block pricing that goes some way towards allaying the concerns of clients while maintaining a balance between scale and price.

## 3.5 Accuracy and completeness

### *SDRN*

The SDRN has reached a good standard of accuracy in terms of road centrelines and naming for the Police A-K area that surrounds the area of metropolitan Melbourne which covers 70% of the roads in the State. There are substantial items beyond the road centrelines in the VicRoads RNDB, and further coordination offers value-added to this state map-base.

The SDRN meets the need of some clients for incremental delivery as it is updated and improved, although this presently incurs significant costs to the OGDC. There are at present over 3000 changes a year, so currency of the database is important.

### *Cadastral*

The cadastral is perceived by some clients as incomplete and even unfinished, but their reasons differ. Problems include the omission of slivers and minor areas, the incompleteness of watercourse boundaries, the need to improve road boundaries, inaccurate locations of addresses at paracentroids, and incompleteness of polygons. While the cadastral is progressing towards full polygonisation, the full dataset (including titles) must await the completion of work by the Titles Office. The cadastral is an active dataset, with many changes and many more in the links to title numbers. These points illustrate how important it is that users contribute to the progress and currency of the database by providing updates and corrections.

The utility of an on-line version of cadastral and full title information is substantial: the provision of such a service in South Australia (the LOTS system) yields large revenues as a service rather than a data product.

### *Topo*

The delivery format of the topographic map-base may need to be altered to suit some current and future clients. Variations in the packaging of this product would therefore be appropriate to consider. This affects the approach to market development, but not pricing principles *per se*.

## 3.6 Pricing and costing

The major issues regarding pricing were license conditions, quantity licensing issues, royalties for on-sale and the forms in which the different data products were packaged. A regular concern was the cost of mounting the data once received from the OGDC, and a wish to have a two way flow of updating information for which credit could be received by the client.

It was evident that an on-line product from the OGDC would have a market, especially when the full titles database became available, but as there was still some way to go to complete the major basic reference products, the currency of each of these reference products was of greater present concern

Marketable products are a combination of packaging and other attributes (eg. accuracy, scale, licence terms etc). The OGDC needs to address the market response to such product variations, as the overall pricing level for OGDC products necessarily depends on the scale at which all forms of data are taken up by different markets.

Pricing differences between major market segments (education, non-profit, operational) was not a concern, although equity between government and commercial clients was.

A continuing concern was that licensing and royalty arrangements become more workable, as these affect the value of the products to different clients. This concern was so strong in some quarters that one client suggested that it would be prepared to pay a substantial amount to avoid incurring further royalties for supplying OGDC data in conjunction with theirs to their own clients.

While there was a general recognition of the effective role of the OGDC, there was also a high level of awareness of the availability and costs of other possible alternative sources of data and updating processes.

### 3.7 Coordination

A consistent theme was the value of enhanced two-way flows of information and data. This ranged from requests for more extensive and detailed metadata, to requests for formal processes for two-way flow of error corrections and enhancements to OGDC data products. This recognition of the coordination role of the OGDC has major implications for more efficient and lower cost production and maintenance of quality datasets. This could include a credit for dataflows to the OGDC – given adequate quality assurance – and a reduction in the current levels of duplication in the maintenance process by other departments and councils.

Suggestions from clients included support for the OGDC to be given whole of government legislative backing, and the provision of on-line data provision and query services by the OGDC.

## Chapter 4

# Current experience

Most of the current literature addresses the political concerns involved in the choice of open access at marginal cost against cost recovery approaches (Blakemore and Singh 1992; Tosta 1993; Onsrud and Reis 1995), and there has been some published discussion of the actual pricing strategies adopted (Bryan 1992; Lawrence, 1993; Post & McLaughlin, 1993; Tollers 1992; Townsend and Arrowsmith 1995), not always including a discussion of the principles on which they were based. Rhind (1992, 1993) asserts that: ‘...no satisfactory, non-arbitrary solution has yet been found to the pricing of geographical data or information...’ and ‘Nowhere have we found a single, logical, equitable, simple and widely accepted method of assessing the charges levied for different customers...’

### 4.1 North America

Other countries use a wide variety of pricing models. The most often quoted examples are the United States, where government data are commonly provided at little or no cost, and there exists a thriving commercial sector selling value-added products based largely on government data. This is only possible because the US Government does not copyright its data, and supplies it without a restrictive license as a condition for its supply. The catch is that the data are currently at a low level of accuracy and indifferent quality, although extensive on coverage and detail. It is therefore ideal as a basis for creating value-added products.

US Federal Government Committees and the Bureau of Transportation Statistics in particular are actively working through the US Federal Geographic Data Committee (FGDC) to raise the standard of spatial data beyond the basic TIGER files that form the spatial part of the census databases, as part of the US National Information Infrastructure initiative (Ground Transportation Subcommittee 1993), and to include linear reference systems as an economy of scale issue for general use in the United States.

As a result, most of these value-added datasets would pass the (arguably) weak Australian tests of originality for copyrighting this value-added data, and in general the quality of the value-added products is significantly higher than the public domain base data. In addition, the legal protection of spatial databases is still not fully clear in the United States due to the Feist case (Yen 1991; Wigan 1994; Eldred 1995). This is different from the Victorian situation, where the Government data is firmly set upon becoming the best quality available and thus to set the common basis for all spatial data to build upon in the State. The legal status of database ownership is reasonably clear in the TRIPS protocols of the last GATT round which set up the World Trade Organisation (Drahos 1995) but these protocols (to which both Australia and the United States are signatories) are not yet in full effect. Licensing and contract relationships for sales of data are therefore still seen to be necessary in both countries.

The pressures on US Government agencies for revenue generation are also evident, but the efficiency gains possible by making Government data widely available can at least be recorded in originating Government agencies by the requirement to list commercial products created from their base data. The US Bureau of the Census Bureau sells data for transfer cost—but can then list specific value-added products and the revenues of the companies creating them in their annual report as a measure of their effectiveness in enabling economic activity in the private sector.

The United States position is often misunderstood. The Federal Government is indeed debarred from copyrighting data—but State and Local Governments can and sometimes do copyright and license spatial data, and also the definition of ‘reasonable’ charges for direct costs of transfer are poorly defined in law, sometimes leading to significant charges (Holland 1996). The United States spatial data markets are imperfect, and the nature of the information can still lead to monopoly positions. Perritt argues that there is no prohibition for local governments charging marginal cost for public data, but that exercising monopoly power to charge higher prices might not be admissible (Perritt 1995).

Ireland (Ireland, 1992) quotes the Blakemore and Sing report on comparative costing of spatial data in Europe and the United States as follows:

...accepting that the USGS policy of long term planning but mindful of value for money, has given it a world lead in digital mapping and GIS... a lead that the American public and private sectors users have exploited to the full. Nor does the Federal Government suffer from the administratively costly mentality of cross-charging for its own sake. Significantly, the USGS did raise its prices in 1981 to cover production costs for digital data. The effect was both immediate and dramatic: demand slumped to the point where charges had to be slashed by 50% to regain lost revenue. Sales climbed back, but it took three years to restore them to their previous level. (Blakemore and Singh, 1992).

This experience suggests that the demand curve for digital data is consistent with a hyperbolic function (as presently adopted in this report), which is asymptotic to zero at very high quantities and correspondingly low prices.

Many cooperative spatial data ventures are springing up as a result of the US National Spatial Information Infrastructure initiative fostered by the Federal Geospatial Data Co-ordination Committee (President: US, 1994; FGDC, 1994) . Examples include BADGER, a service of the BASIC group sponsored at this stage by NASA and a private sector company, is an example of the emerging spatial data cooperatives. This is currently in public beta stage prior to implementing charges, and the current pricing principles are illustrated in Appendix C. Although access to Federal US Government data is clearly part of their stock, other commercial sources are being brought into the on-line data delivery system. Issues of legal responsibility are still emerging (Johnson & Dansby, 1995) , and are an area of importance to Victoria where the OGDC may be able to play a major role.

Canada has different view on government copyright, and pricing policy problems similar to Victoria (Sousa 1993). In the service area, an on line transaction-based model has been set up for a government organisation as a broker between information suppliers (McKay 1994) The pricing principles are based on transaction. Both a flat fee plus a per record retrieved fee and a flat rate transaction fee have been used. The strength of the monopoly position for pricing the cadastre turned out to have been overestimated, as competition

from both within and without government quickly eventuated. However this simple service fee model of pricing as an information broker reached break-even within 18m and subsequently moved on to surplus. A variation on such a service could be offered in Victoria as a coordination role, but might not fit in well with the distribution of OGDC reference databases.

Canada does not share quite the same freedom of information and copyright policies as the United States, and the problems there mirror those currently in Victoria. While establishing a GIS to support the operations of Ontario Hydro, executives noted that a developing controversy in the USA with parallels in Canada is the clash between freedom of information, encouragement of GIS database development and services, and the traditional role of government agencies as providers of baseline data at nominal prices.

Too many GIS users are scientists, and they tend to regard information as something to be freely disseminated rather than owned, subject only to due acknowledgment. At present, charging for the incremental costs of serving a client seems acceptable to most users, but recovery of the cost of discharging one's intrinsic function is not, except where some extra service is performed such as a rush priority. Even within our own corporation there are three conflicting policies awaiting resolution: freedom of information, a requirement or option to charge for internal services, and a prohibition on charging corporate accounts twice for the same good or service. Regardless of what pricing formula may be argued, it is essential that GIS user establish the principle that geographic information is a company asset that must be accounted for. Also, geographic information should be treated as part of the official corporate records. Typically, there would then be a suite of generic company policies and procedures to provide some guidance, even if only as a base from which to create more appropriate ones for GIS. Otherwise, it is all too easy for valuable files to be misplaced, sold or given away inappropriately, or damaged. [Quoted in Archer (1996)]

The role of coordination and setup funding from central Government has made considerable progress in some parts of the United States. A currently active Bill is being processed in California (Assembly Member Bowen 1996) which states:

Because of the high cost of creating and maintaining geographic information databases, many public agencies are seeking greater authority to sell the data. Public agency policies for pricing the data range from covering the cost of data duplication, to recouping the costs from compilation and maintenance of the databases. These policies impede and discourage the sharing of data among public agencies with overlapping geographic jurisdictions and interests. They also threaten to thwart the public's right to open and unfettered access to the government's decision making information.

The full preamble is given here as Appendix B. This summary covers the central problems of determining the cumulative cost of building up a database, decisions on cost recovery for maintaining it, and ensuring that maximal usage is made of the data in organisational efficiency enhancements. The additional United States concern for ready access of the public to the data held by Government for its accountability is covered in the United States by public record access legislation which is based on a different constitutional framework to Australia. This Bill (AB 3431) provides for government action to fund these activities, and a board to oversee and act as a clearinghouse and ensure quality and economies of scale in spatial data assembly, coordination, quality assurance and distribution.

A key segment of this Act under debate is:

This chapter shall be known and may be cited as the Strategic Geographic Information Investment Act of 1996 ... "Framework database" means any categories of geographic information and their attributes that provide a foundation for collection and analysis of other data. A characteristic of framework data is that it serves multipurpose and multiple users with the same data.

The concept of a Framework database is important, and is closely analogous to the proposal of this report to define reference databases for each of the major OGDC data areas. These developments demonstrate the official and political moves in lower levels of government to adapt the marginal cost transfer philosophy of the US Federal Government.

## 4.2 Europe

Spatial data policies in Europe and the United States differ substantially. The countries of the European Union tend to follow a pricing model which incurs substantial costs for the use of spatial data, and this has both yielded significant revenues (in the UK, the sales of the Ordnance Survey (OS) now account for most of their budget) and also major barriers to deployment.

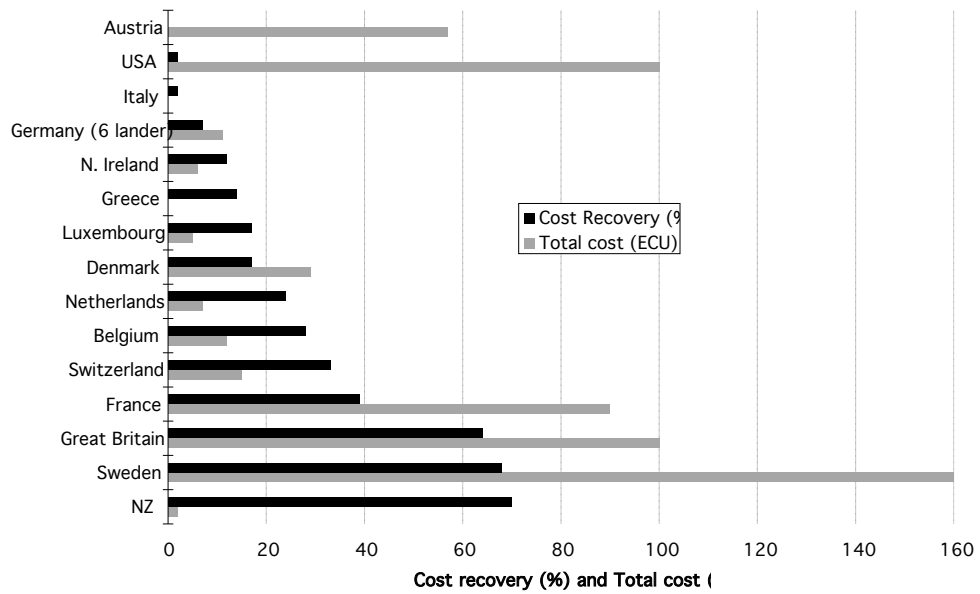
Government monopoly power in spatial information – albeit contestable in principle due to recent developments in differential GPS and automatic mapping – has been exercised more strongly in Europe than the United States. However the European Commission Directives require the avoidance of monopoly trading practices. In addition, government policy for the OS is explicitly to recover full cost (Rhind 1993). It is not quite clear what 'full cost recovery' means, but it is assumed (by Rhind) that this would include contract payments from the Government to cover CSOs (i.e. to pay for products which would not cover their costs in the open market). Rhind confirms that this policy has led to revenue maximising whenever a choice needed to be made between this aim and that of reaching more users.

This policy has led to some limited successes in terms of the organisations in financial terms: the OS reached 68% of full cost recovery for their function in 1991/2 (figure 4.1). It is not yet clear that this has been of overall benefit to the countries concerned (Lievesley and Masser 1992), although the quality of the UK topographic map-base is now 1:1250 v the far coarser USGS resolution of 1:24 000 (Blakemore and Singh 1992), quoted by Ireland (1992).

Although much work is now outsourced from OS, and a 100% cost recovery may well be achievable by 1997/8, as required by the UK Government, Rhind does not suggest privatisation of the OS is appropriate. On the contrary, remaining as a government department or trading fund is viewed as a major competitive asset due to:

- guaranteed access to land
- confidence in the OS by the many competitive VARs and licensees of OS data
- the general guarantee of independence, integrity, continuity and reliability
- the use of OS materials is prescribed in various statutes.

**Figure 4.1**  
*Cost recovery and scale of expenditure*



Clearly the competitive position of the OS is not well resolved, and further changes in policy can be expected. The pricing structure used by the OS is a three-part tariff: a purchase price, an annual maintenance fee, and a charge for usage on a given application. The latter may be regarded as royalty. This corresponds to charges covering initial supply, a revenue stream to obtain updates (although could also be interpreted as a time based charge to simply hold the data even if was not used at all), and a royalty applied to applications or reproductions. The OS supplies data at no charge to VARs who develop applications based on it.

A broad view of a significant number of European specialists is given by J E Dobson, a keynote speaker with Lord Chorley (who chaired the influential UK report on GIS in the mid 1980s) at CoastGIS'95 in Cork: 'Cork presenters lamented that their countries lag behind the United States in GIS development and application; some said 10 years behind, some said 15, but I'd say less than 10' (Dodson 1995). Dobson quotes one speaker who explicitly avoided GIS as a phrase since 'I try not to use the term [GIS] amongst European governments, because GIS has a bad name as a big money sink with no results.' Dobson also observes:

the United States passed through this stage some years ago, and summarised the European position as a wide concern that the problems with data pricing were causing widespread practical problems, and a general feeling that the United States had made the right decision on data pricing.

Why do other countries, on their own admission, lag behind in GIS? The principal culprit is cost reimbursement on GIS data. The message came through clearly at both conferences (Bordomer'95 and CoastGIS'95). Speakers repeatedly complained that data pricing policies are a significant barrier to entry. Americans, who have grown accustomed to inexpensive data, may have a hard time conceiving the impact, so here's a hint: imagine the disastrous case of Landsat extended to almost all cartographic and other spatial data. Get the picture? Some speakers proclaimed that their governments' policies can't last long in the face of United States competition. Their argument is that American companies will undercut the current price structure, providing cheap data to sell software and hardware.

This example is drawn from an area of GIS data that is primarily drawn from remote sensing (Coastal GIS) where both Europe and the United States have direct satellite coverage.

The effects of United States competition in Victoria are far less direct, but the relevance of this quotation from an American periodical is to illustrate the synergy that marginal cost provision of non-copyrighted spatial data has materially assisted the American GIS-related software industry. A number of GIS software systems have been written in Victoria (e.g. Latitude, Mapview and others), and so there are some (weak) parallels to consider in Victoria.

## 4.3 Australia

Current policy across most of Australia is summarised in the ANZLIC agreements (ANZLIC 1990; ANZLIC 1990; ALIC 1992). These principles commit Governments to data exchange at transfer cost, but still provide for charging for value-added products (ANZLIC 1990).

Victoria is not currently a signatory to this agreement.

There are typically three levels of charging:

- full commercial charges (e.g. ABS Census data);
- what is essentially transfer cost charging (e.g. the OGDC's own on-transfer policy for Commonwealth datasets); and
- educational supply arrangements (e.g. provision of data for teaching and non-commercial research at no charge)

These represent three different market segments.

- the commercial sector, where competitors already exist for road centreline data;
- the intra-government sector, where data exchange at no charge has been common in the past; and
- the educational sector, where there is a range of supply arrangements, generally at low or transfer cost, but with strong license conditions to restrict commercial usage.

ANZLIC commissioned a benefits study (ANZLIC 1995) which identified an average benefit-cost ratio of 4:1 for expenditures on creating spatial databases for operational organisations. This is relevant in the context of the present report as it suggests that the precursors to the OGDC's databases were paid for in terms of savings before the OGDC inherited them.

The slow penetration of spatial data systems into local government has also been traced to the organisational and pricing practices for supply of Government data, and the limited encouragement given to assisting the changeover from analog forms of spatial data holding (Peterson and Wigan 1995).

# Chapter 5

## Modelling

In order to apply the pricing principles discussed in this report we have constructed two computerised mathematical pricing models: a single-product model and a multi-product model. The single-product model demonstrates the pricing principles; the multi-product model applies those principle in the circumstances of the OGDC.

### 5.1 Purpose

#### *Single-product model*

Since the single-product model applies to a single product it is unable to simulate the multi-product pricing required of the OGDC. However, this simplification allows it to display its results graphically. The model computes pricing solutions under three pricing regimes: monopoly pricing, marginal cost pricing, and average cost pricing (which, since this is a single-product model, is taken to be the same as Ramsey pricing). Because the user can switch from one pricing regime to another, the consequences of each can be contrasted and compared both numerically and graphically.

#### *Multi-product model*

The multi-product model (see also the *Manual for the Ramsey Model* (FDf Management, 1996) which complements this report) determines price and other variables under a single pricing regime, Ramsey pricing. Unlike the single-product model, which is deterministic, the multi-product model operates within a stochastic framework, performing Monte Carlo simulation. Monte Carlo simulation is a technique for dealing with the fact that some of data we require to run the model are uncertain.

### 5.2 Implementation

Both models are implemented in Excel 5, using the Solver add-in supplied by Microsoft. The multi-product model also uses @Risk 3.1, a simulation system by Palisade Corporation. This is used to account explicitly for the uncertainty in the values of the parameters that must be used to set prices. The models work on several platforms, but specifically require Excel 5 and the appropriate release of @Risk. Both make use of built-in goal-seeking algorithms to find pricing optima as these cannot always be determined analytically.

### 5.3 Pricing regimes

The models compute prices and related variables under the following pricing regimes, each of which is characterised by a different pricing rule:

- **Monopoly pricing** – pricing such that marginal revenue equals marginal cost,
- **Marginal cost pricing** – price equals marginal cost,
- **Average cost pricing** – price equals average cost, and
- **Ramsey pricing** – pricing such that net social benefit is maximised subject to the constraint that the OGDC’s costs be covered.

The single-product model computes prices under all these pricing regimes, as specified by the user (bearing mind that for the single-product enterprise, Ramsey pricing and average cost pricing are treated as synonymous). The multi-product model computes only Ramsey prices, this being the pricing regime recommended in this report.

## 5.4 Model specification

Both the single- and multi-product models use the same generic specification of cost and demand.

### Cost

Total cost is specified as a linear function of quantity (table 5.1):

$$TC = FC + Q.VC$$

As a consequence, average cost is a hyperbola asymptotic to both axes, and marginal cost is equal to variable cost. Other functional specifications of cost are possible, and could be incorporated into any model as required.

**Table 5.1**  
Model  
specification

	Demand	Cost
<b>Total</b>	$Q.P$	$FC + Q.VC$
<b>Average</b>	$\left(\frac{Q}{k}\right)^{\frac{1}{\eta}}; P$	$\frac{FC}{Q} + VC$
<b>Marginal</b>	$\left(1 + \frac{1}{\eta}\right)P$	$VC$

$Q$  is the quantity sold,  $k$  a constant,  $\eta$  the price elasticity of demand,  $P$  the price,  $FC$  the fixed cost of production, and  $VC$  the variable cost of production.

### Demand

Demand has the functional form (table 5.1):

$$QP^{-\eta} = k$$

that is, a hyperbola asymptotic to both axes where the exponent of price is the negative of the price elasticity of demand. Besides being plausible (at least within a limited range) and mathematically tractable, this functional form allows demand to be determined from

(1) a single observed point on the demand curve, and (2) a single estimate of elasticity. It produces a curve with the mathematical form of a rectangular hyperbola, and is sometimes referred to as a 'pivot-point' formulation. Other functional specifications of cost are possible, and could be incorporated into any model as required.

## 5.5 Data inputs—single-product model

Chart 5.1 shows the data requirements of the model.

**Chart 5.1**  
Screen display:  
single-product  
model

	Qty	Cost			Revenue			Profit			Parameters			
	Quantity	Total cost	Average cost	Marginal cost	Total revenue	Average revenue	Marginal revenue	Total profit	Average profit	Marginal profit	Ramsey number	Average cost pricing	Marginal cost pricing	Profit maximising
<b>Parameters</b>														
<b>Cost</b>														
Fixed cost		FCost												
Variable cost		VCost												
<b>Revenue (demand)</b>														
Current price					P_Obs									
Current quantity					Q_Obs									
Elasticity					Elasticity									
Constant					Constant									
<b>Results</b>														
Optimum	Q_Opt													
												Average cost pricing	Marginal cost pricing	Profit maximising

### Revenue

The average revenue—or demand—curve (from which the total and marginal revenue curves are derived, see table 5.1) is uniquely specified by three parameters:

- **Observed quantity sold**—a known (usually the current) level of sales which can be matched to a known price (see next);
- **Observed price**—a known (usually the current) price which can be matched to a known level of sales (see above);
- **Price elasticity of demand**—a measure of the responsiveness of quantity demanded to changes in price.

### Cost

The total cost curve (from which the total and marginal revenue curves are derived, see table 5.1) is uniquely specified by two parameters:

- **Fixed cost**—that part of the cost of production which does not depend on the number of units sold;
- **Variable cost**—that part of the cost of production which depends on the number of units sold.

## 5.6 Data inputs—multi-product model

The multi-product model relies on the same fundamental specifications for revenue and cost as does the single-product model. This means it requires the same data inputs. However, multi-product model expresses some of these inputs in terms of other data inputs. For instance, instead of requiring a single estimate of fixed cost, the multi-product model makes fixed cost depend on a variety of other data inputs which together determine fixed cost. Chart 5.2 shows the data requirements of the model.

**Chart 5.2**  
Screen display:  
multi-product  
model

	All products	SDRN	ESN	On-line	VARs
<b>Fixed cost</b>					
Capital valuation					
OGDC share of capital valuation					
IRR required by Treasury					
Data maintenance: Total					
Data maintenance: By clients (per unit)					
Data maintenance: By clients (total)	0	0	0	0	0
Data maintenance: By OGDC	0				
Fixed cost	0				
<b>Variable cost</b>					
Excluding R&D provision (per unit)					
R&D provision (per unit)					
Variable cost	0	0	0	0	0
<b>Demand</b>					
Proportion of SDRN clients who on-sell (VARs)					
Number of sales per VAR					
Observed quantity					0
Observed price					
Price elasticity of demand					
Constant	0	0	0	0	0
Overhead cost incurred by client					

### Revenue

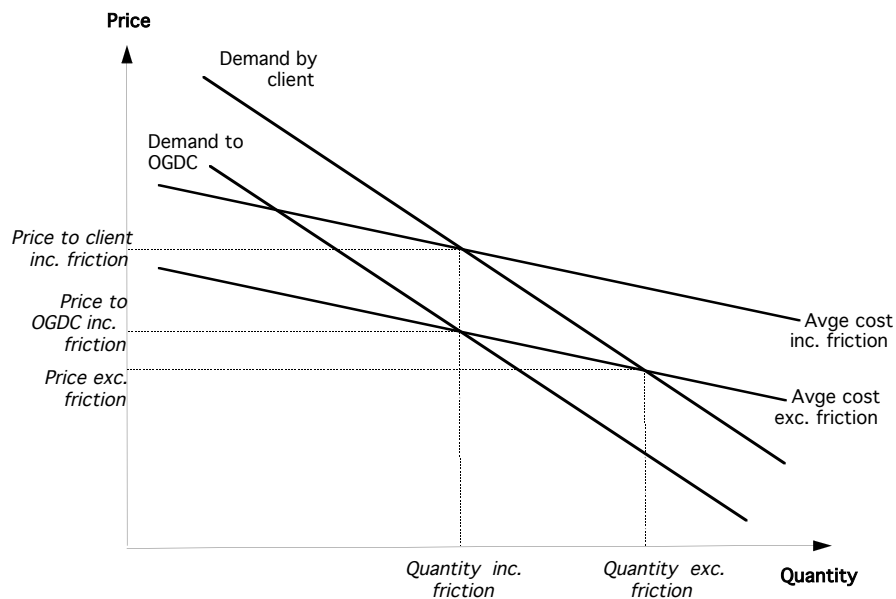
The average revenue—or demand—curve (from which the total and marginal revenue curves are derived, see table 5.1) is uniquely specified by the following parameters for each product.

- **Observed quantity sold**—a known (usually the current) level of sales which can be matched to a known price (see next). *But see exception for royalties, discussed below.*
- **Observed price**—a known (usually the current) price which can be matched to a known level of sales (see above).
- **Price elasticity of demand**—a measure of the responsiveness of quantity demanded to changes in price.
- **'Friction' cost incurred by the client** is the amount that it costs clients to install

data upgrades on to their systems. As several clients have commented, this can be substantial. It affects the demand curve by shifting the entire curve downwards; that is, it reduces the price which the OGDC must charge in order to achieve any given level of sales (box 5.1 and chart 5.3).

- **Royalties.** Some OGDC products are on-sold by VARs with more or less value-adding. The OGDC can be expected to earn royalties from such sales. This revenue is calculated from two parameters: (1) the proportion of SDRN clients who on-sell, and (2) the average number of sales per VAR.

**Chart 5.3**  
Effect of overhead cost on optimal price



**Box 5.1** The effect of 'friction' cost on optimal price

When clients receive a data upgrade, besides the price they pay to the OGDC they incur the cost of installing the upgrade. This 'friction' cost has the same effect as a tax or transport cost. For modelling purposes it can be simulated in two ways: from the point of view of the client, or from the that of the OGDC.

From the client's viewpoint, average cost is higher, but so is demand (see chart 5.3). From the OGDC's viewpoint, average cost is lower, but so is demand, since the OGDC does not receive a part of the apparent price paid by the client. However, in either case the same quantity is demanded.

If the friction cost is eliminated in whole or part, we can simulate the effect either as an increase in demand or as a decrease in average cost. Again, the consequences are the same. In this study we chose to simulate the effect as an increase in demand. In effect, the demand experienced by the OGDC rises to equal the demand experienced by the client. As a result, price falls and quantity increases.

cost.

**Cost**

The total cost curve (from which the total and marginal cost curves are derived, see table 5.1) is uniquely specified by the following parameters.

**Joint cost.** Five parameters are used to calculate the joint cost of providing all products based on the SDRN. This cost must, under Ramsey pricing, be covered jointly by sales of all products based on the SDRN.

- **Capital valuation.** The OGDC inherited spatial data of considerable value. This asset is required to earn a return, if possible. For this purpose it should be valued not at historical cost (assuming this could be established anyway) but at replacement

- **OGDC share of capital valuation.** The above capital valuation may not be totally attributed to the OGDC's clients. The attributable proportion is needed in order to calculate the OGDC's share.
- **IRR required by Treasury.** Treasury requires public assets to earn a specified internal rate of return. When multiplied by *capital valuation* and *OGDC share of capital valuation* it gives the annualised capital cost of the existing data.
- **Data maintenance—Total.** Existing data must be maintained if they are not to lose their value. This is an annual amount which must be added to the annualised capital cost of the existing data to arrive at the fixed cost of maintaining the existing database in a fully current condition.
- **Data maintenance—By clients (per unit).** Besides the OGDC, clients also contribute to data maintenance. This parameter represents the value of their contribution represented as an average per unit sold. It enables us to calculate the total contribution that clients make to data maintenance, and hence the amount that the OGDC must contribute.

**Product-specific costs.** Two parameters are used to calculate the variable cost of providing all products based on the SDRN.

- **Variable cost—excluding R&D (per unit).** The OGDC incurs a (typically small) cost for each product sold. It consists of the cost of the recording media, transcription and distribution.
- **R&D provision.** The OGDC may wish to make a provision for future R&D in the form of a charge for each unit sold.

## 5.7 Outputs

Total, average and marginal revenue and cost are computed for the optimum price (table 5.2).

### *Single-product model*

Outputs for the single-product model are provided numerically and graphically (for example charts D.1 and D.2 in appendix D).

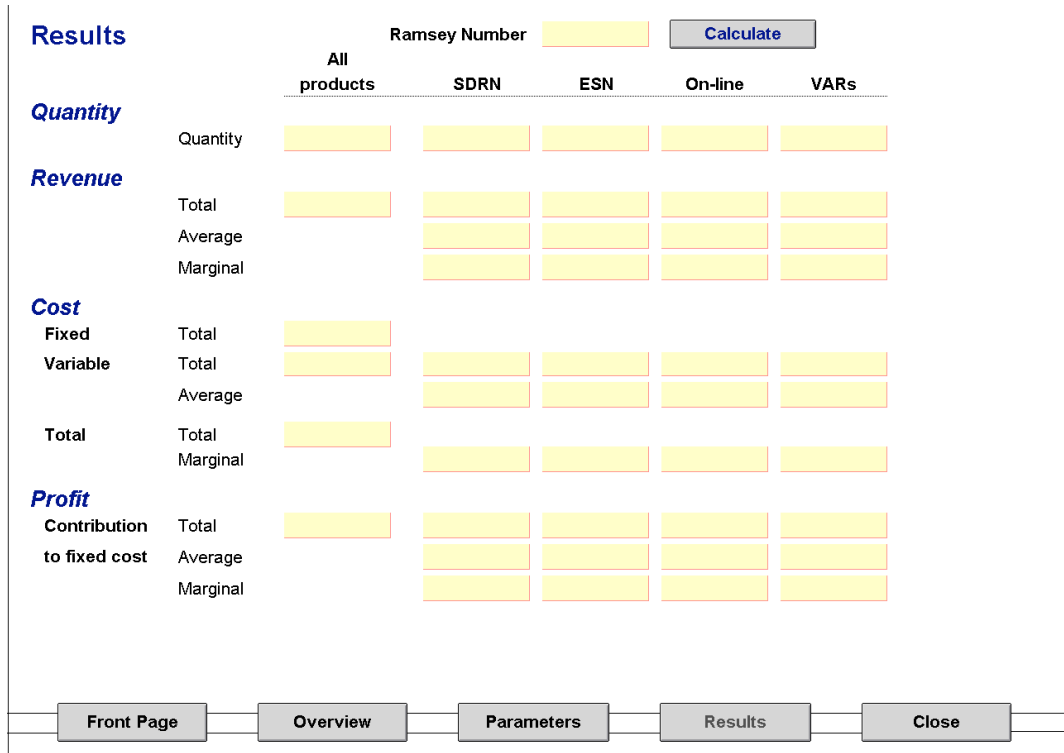
### *Multi-product model*

Outputs for the multi-product model are provided numerically (for example chart 5.4). Since they are stochastic, they can be presented in the form of probability density functions.

**Table 5.2**  
*Model outputs*

	Single product model	Multi-product model	
		<i>For each product separately</i>	<i>For all products combined</i>
<b>Quantity</b>	●	●	
<b>Ramsey number</b>	●	●	●
<b>Cost</b>			
Total	●		●
Total variable		●	●
Average	●		
Marginal	●	●	
<b>Revenue</b>			
Total	●	●	●
Average	●	●	●
Marginal	●	●	●
<b>Profit</b>			
Total	●		●
Contribution to joint cost		●	●
Average	●		
Marginal	●	●	

**Chart 5.4**  
*Sample output: multi-product model*



## 5.8 Modelling the Emergency Services Network

The OGDC tender required an OGDC product be specified as the basis of an illustrative application of the simulation model to explore pricing principles. Although cadastral data (with title information) has usually seen the highest levels of demand (Post and McLaughlin 1993) (see also the South Australian LOTS, on line system), the Emergency Services Digital Road Network was the closest to completion in Victoria, and was already being delivered in an incremental format. It was therefore chosen as the basis for this

purpose.

While GIS has been used in various ways to investigate or analyse emergency services performance (Jones 1993) , the BEST operational centre in Victoria is responsible for real time call handling, routing and dispatching of an increasing number of the emergency services in the State. The requirements of the emergency services road centreline network has driven the SDRN to a high level of quality, and its use has exercised the network heavily. Roughly a million accesses to the SDRN mounted at the BEST emergency response service centre have taken place in the last year. This has provided extensive live checking of the names and roads database. The Emergency Services Road Network is simply the current SDRN, and has effectively set the standard of accuracy in these areas for the SDRN.

The contract with Intergraph to operate the BEST centre included quality assurance aspects. As a result two major rounds of third party quality control has been applied to the SDRN, and has provided a systematic audit of the SDRN as it now stands.

The SDRN has been licensed to BEST on a 2-monthly update cycle, ensuring a high level of currency.

# Chapter 6 Implementation

## 6.1 Product packages

Pricing principles must be integrated with the product packaging and marketing strategy. In the case of the SDRN, which is in principle the top quality product available for road centrelines, a series of less accurate, less detailed, less extensive coverages or less up-to-date versions can be immediately derived from this premium product.

The delivery in a range of user-specified formats, in incremental or complete form, or with various licensing restrictions, creates an entire family of products. Packaging on the basis of royalties at on-sale in a value added resellers product provides a further variation of product packages. This could include the commercial distribution of products created as a by-product of licensed non-profit educational usage.

A product is defined by a set of attributes. These include data quality, updating, license restrictions and delivery format. Table 6.1 specifies a framework for defining a data product. Most of these issues were specifically raised by current OGDC clients.

**Table 6.1**  
*Non-price components of spatial data product specifications*

Category	Aspects			
Content	Area covered	Number of items	Number of attributes	Number of layers
Quality	Coverage and completeness	Currency	Spatial precision	Data structure (e.g. lines or polygons?)
Maintenance	Frequency	Quality Assurance	Incremental v complete reload	
Formats	Physical (e.g. CD-ROM, 8mm tape)	Logical (i.e. in client's GIS software format)	Access (i.e. via Internet to full product, or only limited aspects)	
License	Restrictions on usage	Ownership of additions/ corrections	Quantity of user access terms (i.e. per seat, per application etc.)	Terms of distribution of value-added products
Royalty	Per unit pricing	Per product pricing	On sales by the OGDC of client produced value-added products	
Service level	Supply speed	Customisation	Installation aid	Response to errors etc.

Each of the elements affects what practical pricing strategies can be constructed under the umbrella of the selected pricing principle. Most of the factors in Table 1 can be utilised under any of the different monopoly, market or marginal cost pricing principles described, although many would undermine the clarity of the general principle selected. This is largely inevitable in practice. However, some of these product specifications that could be created under the options in table 6.1 could undermine or obscure the clarity of the marginal cost, monopoly or monopoly pricing principle adopted.

If marginal cost pricing were to be adopted as the guiding principle then a number of the complexities disappear. The discrimination in terms of quality, currency or extent would become irrelevant, as would the pricing and royalty variations. However, the levels of service offered would still be open to being charged for in a variety of ways and license restrictions could still be applied. Consequently, even under marginal cost pricing principles there are still a range of products and also source of revenue that can be secured without violating the marginal cost principle.

A different view is given in table 6.2, where the relative importance of the different areas will differ markedly for policies based on monopoly, marginal or market costing principles

**Table 6.2**  
*Dimensions of pricing strategies*

Area	Significant factors			
Cost	Capitalised investment	Updating and maintenance	Costs of operation and distribution	Transfer costs and CSO inputs
Demand	Monopolies in supply	Stratified markets and elasticities	Market competition	License constraints
Supply	Quality of data	Value added by users	Co-opetition	Coverage

Intellectual property and royalty issues can be covered in a license agreement, but each such constraint would restrict the marketability or acceptability of the product for specific potential users.

The role of license terms in creating greater or lesser value to clients can be expanded on further: a license is essentially a service product rather than a purchase. Other service products could include on-line query access to a centrally held OGDC on-line database, using appropriate query languages to respond to queries. The South Australian LOTS system is an example of such an on line query service (for titles and the cadastre)

One form of license could be the rights to link live to a copy of the appropriate database product over a distributed network, so that the client would not necessarily need to ever take delivery of the product in either a physical or electronic form. While this service (for such this is) would require some equipment within the OGDC, the flexibility of access and license to use could then be segmented by response time, scope, times available for linkage etc. The SA LISA<sup>2</sup> system is aimed at this market, and the San Francisco Bay Area BASIC spatial data cooperative is an example of full product access and downloading of the data over networks.

A key issue is to clarify what business the OGDC is in: the data product creation business, the data service provision business, or the value-added marketing business? All are valid directions, but the pricing approaches would differ substantially.

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<sup>2</sup> LISA is a system developed with CSIRO which allows multiple spatial databases to be accessed remotely as if they were a single database. It forms the delivery platform for the LOTS (Sedunary 1990) on-line enquiry and the DCDB digital cadastre database services in South Australia

Enabling the reference products to be produced and distributed is a current market, with no particular reason for internal services to be based on data held within the OGDC, and which is indeed already serviced by contracting out. However, an on line query service would be the most up to date integrated database available for Titles and cadastre (once the titles are all held in polygonal form), and there is a quite different case to be made for such a service remaining within the OGDC, as it would draw on the most recent data, represent the best information currently available, and could generate significant revenue from these characteristics. Access to such data as a query service is not the same business as the sale or licensing of spatial datasets for others to utilise.

## 6.2 Stakeholder liaison

Public discussion of the proposed basis for transparent pricing in segmented markets provides an excellent opportunity for establishing user and potential user understanding of the approach, and participation in the next stages of price and product strategy development and marketing assessments. It would be useful to undertake such a public workshop at a University to establish the process on neutral grounds.

However, there is also a demonstrated level of interest in participation in active client groups, and for the joint development of two way data flows. Such mechanisms are a major building block in the process of establishing working partnerships, and will encourage the value-added knowledge based industries that can be based on a common, accessible, respected and well exercised and continually updated spatial data information base.

## 6.3 Market research

The pricing principles and structures proposed permit a set of consistent prices to be constructed. However the relative utility of different aspects of quality, currency and format has yet to be established. Determining demand elasticities from market testing still requires product packages to be designed and selected. Initial exploration of utility functions by using Stated Preference surveys can address this issue, and have a good record in assessing demand elasticities and product utilities in advance of field testing (Hensher 1994). It is also possible to combine revealed (i.e. field sales results) and stated preferences to make use of all the information available.

These approaches have been gaining sound credence in many application areas, and have much to offer in information product marketing. Some work in this area would be a sound pre-competitive investment, and add value to the prospective VARs for OGDC data.

## 6.4 Market segmentation and CSOs

### *Education*

The OGDC has a range of responsibilities exercised on behalf of the State in addition to the coordination of spatial data production. These include:

- Ensuring the production of key spatial databases
- Setting standards for the quality of reference spatial datasets, and appropriate Quality Assurance measures
- Encouraging the adoption and efficient utilisation of digital spatial data, and;
- Fostering the availability of appropriately skilled workforce to enable efficiency gains and service levels for the State

The internal production, provision and distribution of spatial datasets are not explicitly mandated to meet these goals, but as the market take-up and the benefits of State standard reference databases requires active participation as these products emerge, not only is the OGDC taking a responsible and active role in the production, coordination of the key spatial databases, but also in mediating the necessary standards, information provision, legal coverage and client coordination interchanges required to fulfill the OGDC mission.

The user feedback indicates that the OGDC is recognised as having a key role in each of these areas.

The relevance to market segmentation is that a continuing process of encouragement of early adopters of spatial data-based operations requires a steady stream of visible initiatives and the flow of skilled staff that result from these R&D activities. The provision of spatial data at transfer cost to Universities and to Schools lowers the barriers to this process, and positive support makes the difference between other areas chosen by university students and staff. The educational sector is therefore an appropriate area to treat as a special market segment, and the cost forgone by provision to this sector may be regarded as an efficient policy measure to support State goals.

The nature of information products means that as long as this market does not impinge on the commercial sales, such provision (which is also in accord with ANZLIC guidelines) is appropriate.

It might be assumed that this provision should be credited as CSO, but this is likely not to be that case for a number of reasons:

- The staff involved increase the availability of a scarce resource in Victoria, leading to a greater ability to take up commercial use of the OGDC products.
- Universities and students are now increasingly sensitive to the need to convert knowledge created into a deliverable form for community benefit. This leads to involvement in applied research contracts with the private and government sectors, and to new products in their own right, leveraged on an OGDC base.

Appropriately flexible data usage licenses can cover these situations, and indeed encourage them, and thereby lead to additional sales as well as skilled staff.

It is therefore important for the OGDC to obtain feedback on the usage made of OGDC

data when provided to educational sector, to encourage the broadest beneficial outcomes. Summaries of these outcomes should form part of annual OGDC reporting.

This market segment can be defined by improving and revising the current legal license agreements used for educational institutions in collaboration with them.

***Individuals***

A recent development in the community has been the shift in expertise and analytical power from Government service to the community.

This is the result of three trends:

- decreasing specialist activities and training within government, as outsourcing and corporatisation and privatisation progresses;
- swift take-up of powerful computing systems by individuals in the community (current home PCs are now becoming more powerful and capable than those purchased for most business applications);
- rising educational standards as well as computing competencies across the community.

The processes of consultation within the community have not kept pace with other trends in government, and the ability of individuals to use, understand and contribute to debates that previously demanded the skills and capabilities held solely within government has risen.

Spatial data touches a many of the most sensitive areas of community concern, and a demand to access community-held data for contributions to community debates is likely to arise.

Servicing this market would require similar agreements to those for the educational sector, but appropriate licenses should be developed for this area as it will often involve only small areas or quantities of data.

This specific market should be treated as a CSO, and any of additional marginal costs involved in setting up to service data provision to it be made transparent and funded by central government. The actual provision of the data could then be done at media cost.

This proposed CSO could well also capitalise the costs of a substantial fraction of potential FOI requests.

The quarantining of this market is also possible. If data is provided only in one or two standard formats for the entire dataset, the costs of tailoring a subset would be chargeable—and the evidence is mounting that the majority of users of all kinds prefer to pay for such a service. Those capable of handling the entire dataset and transforming it as they require have little overlap. For example, the entire VicRoads RNDB has been made available almost in such a form, with little impact on the SDRN product of the OGDC.

Pragmatic problems of monitoring the legal status of such provision might be handled by publishing both the terms of the licenses and the names of those individuals to whom they had been provided.

This area is clearly difficult to handle, but as the information power of government relative to individuals has altered so dramatically, it will have to be faced at some point. The principle has therefore been included in this section on possible market segments justifying different pricing treatment.

### ***Community records***

Spatial data has historically been delivered in the form of physical maps, and both copyright and mandatory State repository library provisions applied. With the move to digital holdings of the data that were previously available in physical form, repository requirements are not always addressed by the creators of digital databases. This issue has been addressed in the United States, where digital data are deposited in over 150 libraries (Jones and Prescott 1995) , but needs also to be considered in Victoria.

While providing copies of—say—CD-ROMs to the State repository library would be a straightforward process, the access to this data would not necessarily be so easy to formulate. It is recommended that repository copies of the reference databases be provided to the State repository library at annual intervals, or at major updates (whichever is the less frequent), and that the repository libraries hold these records in a form where access to them was not available for perhaps a decade, and a special license be created to meet the need to ensure that these materials were held as archival only for that period, and clarifying the license status once the archival period had elapsed.

## Chapter 7

# Conclusions

### 7.1 Key recommendation

- Adopt Ramsey pricing as the pricing principle for products in segmented markets.

### 7.2 Subsidiary recommendations

- Define and have key stakeholders endorse reference levels of each major product
- Run a public workshop for stakeholder consideration of this principle, and to focus on pricing strategy and market development issues.
- Form stakeholder and client coordination groups with the objectives of
  - improving two way continuing communication
  - establishing data update exchange procedures and credit processes
  - endorsing reference products
  - initiate market surveys and field testing of product packages
  - improving VAR opportunities.
- Review licence and royalty structures.
- Adopt a block pricing model for large organisations, based on administrative units (divisions or sections). Senior management may then be treated as a single administrative unit if access (typically low- intensity) is required for this group.
- Consider legal protection through expert client group endorsement process as 'current acceptable state of practice'.
- Monitor and publish usage, application and product production by third parties, and subsequent usage and sales revenues as part of OGDC annual reporting.
- Plan for on-line title/cadastral services as a separate reference product.
- Provide for educational and individual licences as separate market segments.
- Provide for digital map supply to repository libraries.

# Appendices

## Appendix A

# Summary of interviews with OGDC clients

Key points made by the clients interviewed about the project are summarised below under major headings.

### A.1 Pricing and costing

- Pricing issues were on all occasions qualified by issues of quality, completeness, legal concerns or data format issues.
- Treasury requires an 8% internal rate of return.
- Cadastre building costs of about \$10m to Melbourne Water led to major efficiency gains at once.
- Cadastre in rural areas had no Melbourne Water startpoint equivalent & will cost ~ \$20-40m to digitise.
- Cadastre initially cost Melbourne Water up to ~ \$8-10 per metropolitan property in 1988.
- Cadastre pricing varies on a per parcel price which differs by market segment.
- Cadastre updating cost, now that the metro area digital cadastre is stable, is about \$425k pa.
- Client department wants to levy royalties on its data layers: model is not yet determined.
- Digital elevation model will be of interest, but at a cost per seat may preclude its take-up.
- Licensing terms needed for VARs to handle value-added sales at lower client cost.
- Low initial price, get revenue streams later.
- Low parcel activity rates make the per parcel cadastre update effort & money costs very high.
- Market assessment for variations on Tiling as the sales unit for topographic data.
- Market segmentation pricing.
- Market surveys now needed.
- Market segmentation: few want all the data; most prefer an extraction service
- OGDC custodian for and resells electoral boundaries: does not claim ownership
- OGDC custodian for and resells municipal boundaries: does not claim ownership
- OGDC prices Commonwealth and Local Government Board data at transfer cost: ANZLIC
- OGDC sells hard-copy maps
- OGDC to ensure that client data updating and improvement is accepted and credited
- On-line provision raised SA from 7000 manual title inquiries a year to 20,000 a day.
- Operation of the OGDC could support continuing SDRN product for about 4

people/\$250k pa.

- Package of products can cross-subsidise some products
- Potential VARs are already apparent for intermediary services to LGAs etc.
- Prefer 60000 data sales at \$50 that 6000 at \$500.. get data into use
- Pricing policy needs to allow for exchanges of data with partner organisations
- Pricing to attract industry development
- Real concern over the possibility of a Rhind/UK Ordnance Survey high-price policy
- SDRN build costs have been comparatively low: built on cadastral & topographic map bases cost about \$1m to get it up initially
- SDRN incremental updates currently costly to provide: must maintain multiple history files
- Set prices for extracting tailored data as a service
- Sublicensing & subset distribution complexities could be dealt with by a fixed fee per year
- The per-parcel price of updates often seems expensive, and alternatives are considered
- Topo building costs from scratch has been ~ \$32,000 for each of the 1,600 sheets.
- Topo pricing is based on numbers of Tiles plus a quantity discount
- Topo pricing is currently still based on exact Tiles plus a surcharge overlapping a Tile edge
- Topo pricing not directly connected to extraction or delivery costs

## A.2 Legal issues

- Client groups to endorse reference products as a legal liability protection to all
- DoP has a legal liability to issue a correct certificate: this requires QA support
- If updates become a (legal) quality assurance service then per parcel cost not so relevant
- Legal issues need to be addressed
- Need a legal QA basis for OGDC data completeness: example of missing addresses given
- OGDC to ensure that legally defensible utilisation of the data can be assured
- User committee to sign off on a acceptable set of reference Datasets

## A.3 Data format

- A real need for the OGDC to provide data in the clients preferred native data format
- An incrementally updatable version of the cadastre is required
- Cadastre and topo are supplied in DGN (Intergraph), can SDRN be in DGN, not in ArcInfo?
- Cadastre in ArcInfo format would reduce our costs in using it
- Cadastre in incremental format far preferred: some updates not economic to re-load
- Councils need cadastre in incremental form due to their extensive links to base cadastre
- Incremental releases of the cadastre would be valued

- Reloading a new cadastre release costly: can cost a full week of work and full computer day
- Specialised translators for ArcInfo/DGN to SmallWorld coverages are costly
- SDRN in incremental form desired, up to a monthly update frequency

## A.4 Quality

- Concerns over learning curve for new local data suppliers for SDRN to meet quality level
- Data quality information at several levels needs to be developed and made widely available
- Encourage SDRN in use by BEST, will pressurise higher quality from LGAs
- Expressing updates as QA is persuasive, even to those who find per parcel rates too expensive for comfort.
- Possible use of a third party Quality endorsement process
- Quality means completeness (not simply spatial accuracy)
- Quality to needs to be continually upgraded
- SDRN is now good, but Intergraph has paid for extensive quality assurance to get it there
- Slow response of OGDC data supply contractor a concern

## A.5 Licensing

- A greater variety of licensing models is needed
- About 400 clients to date, mainly for the cadastre
- Access, licensing terms and specification for on-line delivery and inquiry services
- Floating licenses for data would an improvement on current seats licensing
- License clause 'not to modify or reproduce' is largely unworkable in its present form
- Licensing of map production from cadastre with additional royalties a concern
- Licensing problems with modified and extended data products within licensed organisation
- Transformed products are created internally: sometimes by simplification of OGDC data

## A.6 Accuracy and completeness of the SDRN

- Accuracy of SDRN data is not yet good enough from our standpoint
- Concern over the 'essentially 1991' dated Postcode boundaries in the cadastre
- Reference Road Centre Line product will be in place by 3Q96 for police Areas A-K
- Road Centre Line product has unique feature identifiers, thus incrementally deliverable
- Roads as polygons (as in NSW) rather than as space between the cadastre land parcels
- SDRN for rural areas now needed for emergency services, with overlaps into next State(s)
- SDRN for rural Victoria looked forward to for consistent addresses

- SDRN (A-K) will be reference quality by 3Q96 with next Intergraph QA cycle completed
- SDRN does not include turn tables (no right, left or U-turn designations)
- SDRN gets about 3,000 new roads into the map-base per year
- SDRN completeness in naming is critical requirement for Emergency services
- SDRN currently covers Police areas A-K only, which include ~ 70% of the states roads
- SDRN includes overpasses and underpasses, but not VicRoads intersection layouts
- VicRoads RNDB is the reference base product for derived nets e.g. for TRIPS and accidents
- VicRoads State road network extensively tuned for accurate LGA topology alignments etc.
- VicRoads State road RNDB network does not correspond to SDRN at present

## A.7 Accuracy and completeness of the cadastre

- Addresses are coded to a centroid in the cadastre, not to physical location of building
- A reference cadastre product still possible in 1996, with polygons
- Cadastre must be extended to include slivers and title topology rather than just line features
- Cadastre needs river, creek and coastline improvements
- Cadastre still contains duplications and errors in new releases-even whole subdivisions lost
- Cadastre accuracy improves as new plans (accurate to mm) enable linked parcel updates
- Cadastre comparison with CitiPower GPS and inertial survey found few errors
- Cadastre excludes a significant number of small items at present due to 'lack of interest'
- Cadastre has 50,000 title changes and 200,000 ownership changes (i.e. 10% pa) a year
- Concern over use of paracentroids for address points : problems when combining layers
- Lack of accurate road (not parcel) boundaries and the omission of many slivers a concern in the cadastre
- Land parcels and titles as polygons: the cadastre is not done until this is complete
- Precision location is needed in the (reference) cadastre e.g. for accurate pole locations v road
- River and watercourse boundary problems still with the cadastre
- The reference cadastre product must await completion of Torrens titles by Titles Office
- The reference cadastre product should include all slivers

## A.8 Accuracy and completeness of the topographic coverage

- Reference topo product (with full DEM) still as much as 3-5 years away
- Topo is still limited and should be available on CD-ROM for all State, not just

mapsheet

- Topo Digital Elevation Model will be completed in 3Q96: a major value-added platform
- Topo has a 1:25,000 digital statewide coverage

## A.9 Coordination

- An updated information flow State coordination mechanism is needed
- Assured data access : clarification as what will be accessible to companies to use
- Problems due to lack of feedback of updates/ data to the OGDC are occurring
- Better, regular, communication between clients and the OGDC sought
- Multiple bodies doing cadastre parallel maintenance is a growing issue
- Cadastre and SDRN looked to for mutual consistency
- Cadastre progressively has polygons for titles and keys directly to Titles Office database
- Competitors exist: the OGDC coordination role requires some competitive neutrality
- Ensure that data flows back to the OGDC arising from added quality by clients
- Greater coordination with VicRoads, DCR etc. with additional feature layers
- Greater emphasis on the enabling Coordination function of the OGDC
- Independently of the OGDC, updated Melbourne City Council cadastre with new photomapping and digitising
- Lack of knowledge as to when water boundaries will be in the cadastre
- Mapping is not a core organisational skill, so buy in OGDC data
- More metadata is required
- No formal data exchange arrangements with the OGDC
- No formal mechanism for feeding back errors found to the OGDC
- No formal mechanism to pass back errors found or polygons created from the line cadastre
- No formal process to feed back continuing updates/error corrections to the OGDC
- OGDC needs to set up a series of client groups to improve liaison
- OGDC to ensure that legally defensible utilisation of the data can be assured
- OGDC to enable on-line access to reference datasets internally or in client systems
- OGDC to exercise a Whole Of Government power to coordinate data take-up and standards
- OGDC to make metadata more widely available
- Some councils have done extensive spatial data improvements, but no feedback to the OGDC

## *Appendix B*

# Californian Bill AB 3431

The following is an extract from the initial tabling of Californian Bill AB 3431, introduced 23 Feb. 1996.

The Legislature finds and declares all of the following:

(a) Quality information is essential to maintain the health, safety, and welfare of the people of California and California's economy and environment, and it is the responsibility of state government to ensure that crucial information is available for effective operation of the public sector.

(b) The lack of quality information leads to poor decisions by public and private organizations.

(c) Crime prevention, property management, energy resources planning and service delivery, land planning, risk assessment, economic development, emergency response, pollution control, education, delivery of human and social services, transportation management, natural resources management, and environmental decision making are all functions of the public and private sectors that require large amounts of high quality and available information. This information can be indexed by its geographic location, and, through the use of geographic information systems, can be retrieved rapidly and effectively.

(d) Computers and electronic databases proliferate throughout government, and automated mapping and geographic information systems are the fastest growing areas for information technology.

(e) Data are often collected and databases designed for isolated reasons, and seldom with consideration for the needs and requirements of those outside the sponsoring organization. California cannot afford data fragmentation. A new direction must focus on coordinated actions and better allocation of existing financial resources at all levels of government.

(f) The capture of geographic information is expensive, and public and private organizations must be encouraged to work together to create shared geographic information databases, thus avoiding redundancy and duplication.

(g) The update and maintenance of existing geographic information system databases is an effort that is critical to the effective use and preservation of the resources invested in geographic information systems.

(h) Geographic information is heavily relied upon and critical to public agencies, public utilities, educational institutions, and private organizations, and provides the foundation for assessment and planning of services and actions.

(i) The flow of information between public organizations and the citizenry must be unfettered in order for public organizations to respond rapidly and successfully to the health, safety, and welfare concerns of the people of California.

(j) Increased electronic access to the public's information systems will enhance the delivery

of public services and the availability of information.

(k) California must implement a comprehensive strategy for the development, funding, and coordinated use of geographic information to successfully serve its citizens and to compete in the new international economic system.

(l) Automated mapping and geographic information systems offer great value to the public. It is a policy option of each public agency to decide whether the information that it has gathered, maintained, and stored in these systems should be offered to private commercial users as a public subsidy, or on a fee-for-service basis.

(m) Because of the high cost of creating and maintaining geographic information databases, many public agencies are seeking greater authority to sell the data. Public agency policies for pricing the data range from covering the cost of data duplication, to recouping the costs from compilation and maintenance of the databases. These policies impede and discourage the sharing of data among public agencies with overlapping geographic jurisdictions and interests. They also threaten to thwart the public's right to open and unfettered access to the government's decision making information.

(n) It is the intent of the Legislature in enacting this act to redress these problems and take better advantage of opportunities described in this act. It is the further intent of the Legislature to provide an alternative source of funds for public agencies to create and maintain geographic information databases without having to sell the public data. Finally, it is the intent of the Legislature to establish a board to coordinate open exchange of geographic information among public agencies by establishing compatible standards for framework information and serving as a clearinghouse for access to data

# Appendix C

## Spatial data on the Internet

The following is a reprint of part of a World Wide Web page (<http://www.basic.org>) devoted to the sale of spatial data for the San Francisco area.

Prices subject to change without prior notice. See last line of this page for date of this revision. These prices supersede any earlier list.

Product Name	Description	List Price (\$)	Sponsor Discount (%)	Associate Discount (%)	Subscriber Discount (%)	Individual Discount (%)
one meter aerial	1MB					
PA DOQQ	DOQQs for Palo Alto sheet	=approx \$0.20	100%	100%	100%	100%
one meter aerial photo	DOQQs 1MB					
SF DOQQ	for 100K San Francisco sheet	=approx \$0.20	100%	100%	100%	100%
one meter aerial	1MB					
SCC DOQQ	photo DOQQs for Santa Clara County urban area	=approx 2.5% of \$2.00	30%	10%	0%	0%
Digital Line Graphs	DOQQ 20% of					
DLG for Palo Alto, SF and SCC	(varies with type)	\$2.00	100%	100%	100%	100%
Thirty meter Digital	1MB					
DEM Models	Elevation for one Palo Alto, (4xDOQQ) SF, and SCC	=approx \$10.00	30%	10%	0%	0%
Geodetic	1MB					
GCP Points	Control 33% of a county**	=approx \$3.00	30%	10%	0%	0%
CD-ROM						
CD-ROM media	( up to 650MB)	each* \$95.00	30%	10%	0%	0%
8mm 8mm tape	each* (up to 1GB)	\$95.00	30%	10%	0%	0%
4mm DAT						

4mm tape (up to 2GB)	each*	\$95.00	30%	10%	0%	0%
1/2" tape						
0.5inch 6250bpi (up to 1 GB)	each*	\$175.00	30%	10%	0%	0%
1/4" QIC						
QIC tape (up to 150MB)	each*	\$105.00	30%	10%	0%	0%
Magneto						
MO650 Optical Disk (up to 650MB)	each*	\$225.00	30%	10%	0%	0%

\* price is for one piece of media, shipping (US Postal Service) and handling only. Data written to media is priced in table above and adds to media price. For example three DOQQs from the Palo Alto sheet, delivered to a customer on a CD-ROM, would cost \$125 (=3x10 + 95) before discount (if any) plus tax.

\*\*minimum GCP download is for a county-wide dataset (approx 1.5-5MB).

All sales are subject to sales tax according to applicable state and federal law. All prices are in US dollar currency.

Minimal data unit for off-line delivery of selected standard data products: for DOQQ (approx 50MB), and DLG (approx 5MB each type), DEM (1MB), GCP dataset by county (approx 1.5-5MB).

Refer to Member Information for descriptions of the types of members.

Customers who are not members are in the zero discount category.

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 [Return gif]Return to the Product and Services page for descriptions of data products and off-line delivery.

[Return gif]Return to the BASIC Home Page.

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# Appendix D

## Ramsey pricing

This appendix explains some of the economic theory underlying Ramsey pricing.

### The Ramsey price

Ramsey pricing (also called ‘constrained social welfare maximisation’) is implemented by setting price such that net social benefit is maximised subject to the constraint that the OGDC’s costs (including an appropriate return on capital) be covered.

### The Ramsey number

All the pricing regimes mentioned in this report can be characterised by a parameter known as the Ramsey number (table D.1).

**Table D.1**  
Pricing regimes

Regime	Objective	Condition <sup>1</sup>	Ramsey number
<b>Monopoly pricing</b> (Profit maximisation)	Maximises profit	$MC = MR$	$\lambda = 1$
<b>Marginal cost pricing</b> (Social welfare maximisation)	Maximises net social benefit	$P = MC$	$\lambda = 0$
<b>Average cost pricing</b> (Full cost recovery)	Covers full cost. May also maximise net social benefit for the single-product enterprise	$P = AC$	$0 \leq \lambda \leq 1$
<b>Ramsey pricing</b> (Constrained social welfare maximisation)	Maximises net social benefit subject to the constraint that total cost be covered	$\left(\frac{P - MC}{MC}\right)\eta = -\lambda$	$0 \leq \lambda \leq 1$

<sup>1</sup>See glossary at end for interpretation of symbols.

Monopoly pricing and marginal cost pricing bracket the range of prices which the OGDC may wish to adopt. The OGDC will never rationally price outside this range because to price above the monopoly price decreases profit without any compensating increase in net social benefit; and to price below marginal cost decreases net social benefit without any compensating increase in profit. The ‘Ramsey price’ lies between these two limits, and, for the single-product firm, is normally the same as average cost.

### Pricing regimes—a graphical illustration

Charts D.1 and D.2 show pricing regimes for the single-product enterprise. The case of the multi-product enterprise is not shown because it is impossible to plot average cost where—as is likely—there are joint costs for different products produced by the enterprise. However, the single-product enterprise can for illustrative purposes be regarded as a special case of the generalised multi-product enterprise. For the single-product enterprise the Ramsey price normally corresponds to average cost pricing. For the multi-product enterprise the existence of joint costs prevents one calculating an average cost price; however, the Ramsey price has the same effect on the multi-product enterprise as does average cost pricing on the single-product enterprise.

**Monopoly pricing** is characterised by a Ramsey number of unity. Under monopoly pricing, price is higher, and quantity lower, than under any of the other pricing regimes (chart D.1); and profit is maximised (chart D.2).

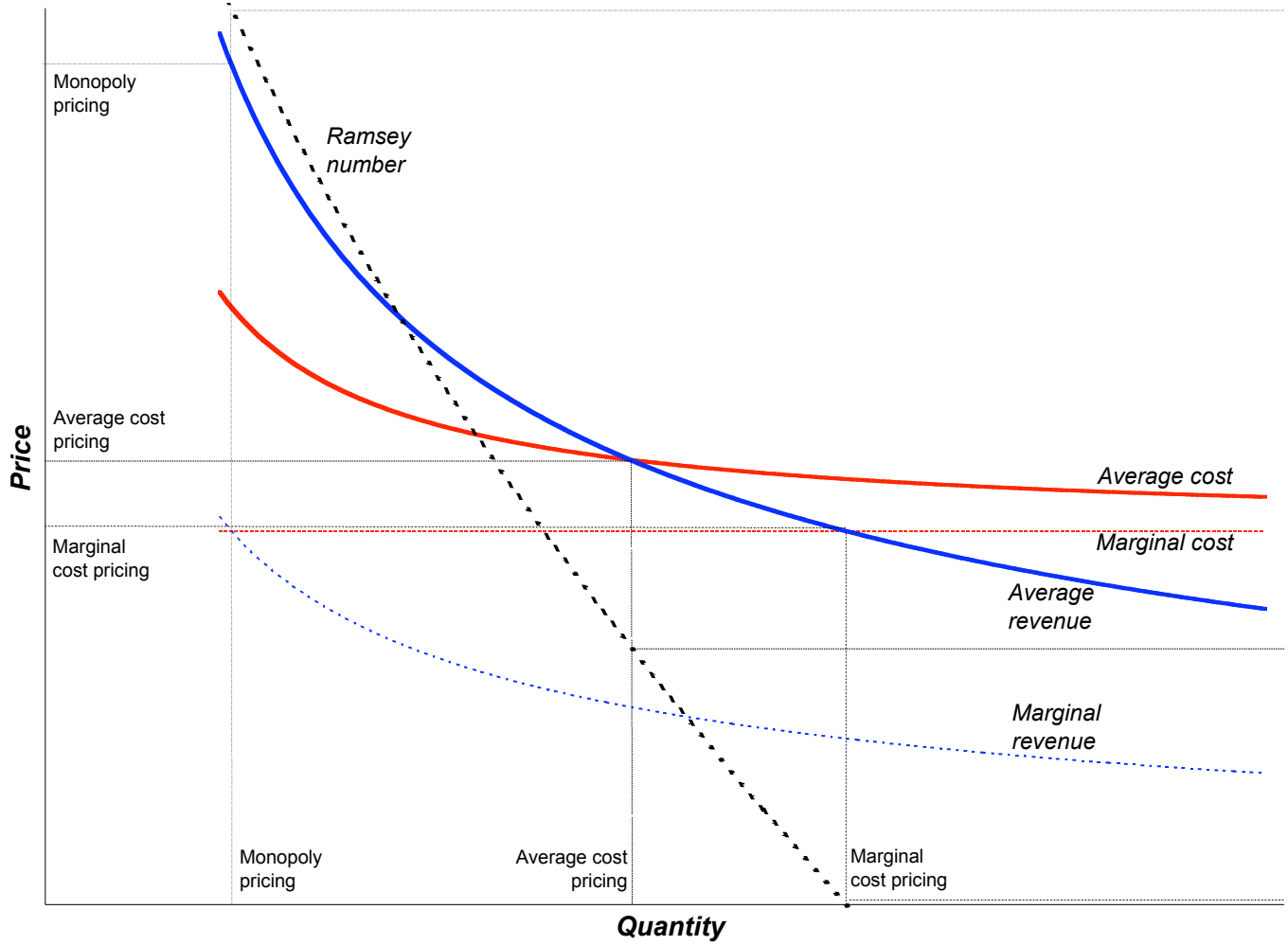
**Marginal cost pricing** is characterised by a Ramsey number of zero. Under marginal cost pricing, price is lower, and quantity greater, than under any of the other pricing regimes (chart D.1); and profit is negative (chart D.2).

**Average cost pricing** is characterised by a Ramsey number of between zero and unity. Under average cost pricing, price is lower than under monopoly pricing but higher than under marginal cost pricing; and quantity is higher than under monopoly pricing but lower than under marginal cost pricing (chart D.1). Moreover, no profit is made (chart D.2).

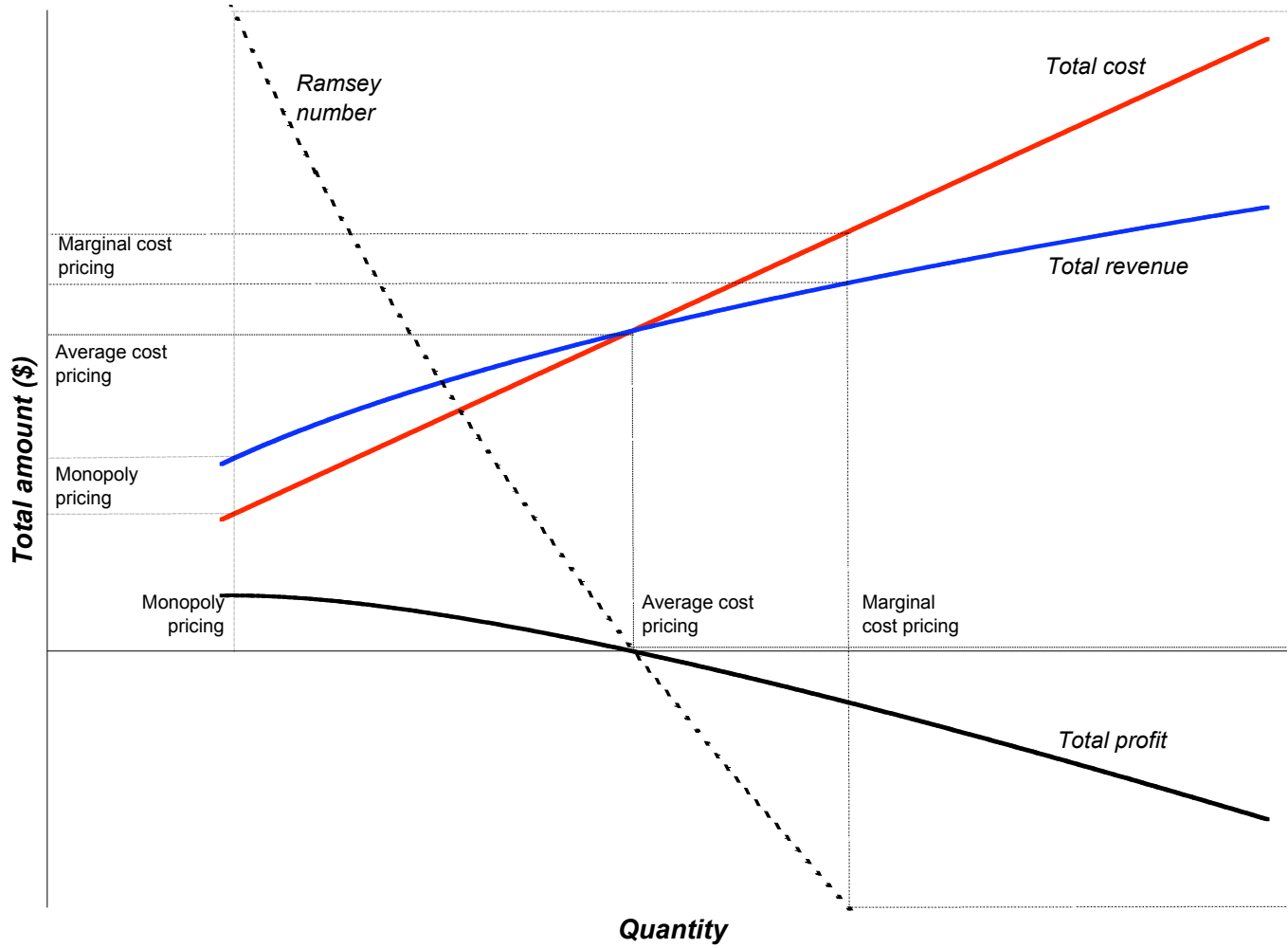
***Some practical problems with Ramsey pricing***

Under some conditions Ramsey prices can be extremely sensitive to changes in price elasticity of demand. This occurs when minus the price elasticity of demand approaches the Ramsey number in numerical value. At this point, the Ramsey price explodes upwards, becoming undefined when minus the price elasticity of demand equals the Ramsey number. These and other practical issues are documented in Tye (1990). However, we note that all pricing regimes demand a knowledge of price elasticity of demand, not just Ramsey pricing.

**art D.1**  
 Illustration of  
 pricing  
 policies for a  
 hypothetical  
 single-product  
 enterprise:  
 average and  
 marginal cost  
 and revenue



**art D.2**  
 Illustration of  
 pricing  
 policies for a  
 hypothetical  
 single-product  
 enterprise: total  
 cost and  
 revenue



# Glossary

ABS	Australian Bureau of Statistics
AC	Average cost
ALIC	Australian Land Information Council
ANZLIC	Australia New Zealand Land Information Council
AR	Average revenue
ArcInfo	A major GIS from ESRI Corporation
BEST	Bureau of Emergency Services and Telecommunications
BTS	US Bureau of Transportation Statistics
Cadastre	The land parcel database for Victoria
CSO	Community service obligations
Co-opetition	A process or precompetitive collaboration, or a strategic alliance to co-market with erstwhile competitors
DCR	Department of Conservation and Resources, Victoria
DEM	Digital Elevation Model – a digital description of the profile of Victoria
DLG	Digital Line Graph
DoP	Department of Planning, Victoria
FGDC	US Federal Geographic Data Coordination Committee
FOI	Freedom of Information legislation and requirements
GPS	Global Positioning System operating from NavStar satellites
ISO	International Standards Organisation
LGA	Local Government Authority
LISA	Land Information Systems Architecture – a joint software development by CSIRO and the South Australian Department of Environment and Natural Resources
LOTS	Land Ownership and Tenure System, South Australia
MC	Marginal cost
MIT	Melbourne Information Technology Systems (took over sales of the Melbourne Water spatial database when MIT was formed)
MR	Marginal revenue
NASA	US National Aeronautics and Space Administration
OGDC	Office of Geographic Data Coordination, Victoria
OS	The Ordnance Survey: the UK national mapping authority

P	Price
Paracentroid	A location (8m from the boundary) arbitrarily designated as the centre of a land parcel or title
Polygon	A complete and continuous closed outline of an area
QA	Quality Assurance
RNDB	Rural Network Database: VicRoads ArcInfo based rural road network
ROI	Return on Investment
SGTS	Standard Geographic data Transfer Standard
Topo	Topographic mapbase for Victoria: terrain shape and contours
SDRN	State Digital Road Network of Victoria: currently covers only Police districts A-K
SmallWorld	A major GIS and database system widely used in the utility industries
TRIPS	A major transport planning and modelling package used by VicRoads
USGS	US Geologic Survey: the US National Mapping Agency
VAR	Value added reseller
$\eta$	Price elasticity of demand
$\lambda$	Ramsey number

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