The Recreation Use Value

of

NSW Marine Parks

PREPARED

FOR THE

NSW DEPARTMENT OF ENVIRONMENT AND CLIMATE CHANGE

BY

GILLESPIE ECONOMICS

June 2007

Disclaimer

This report was prepared by Gillespie Economics in good faith exercising all due care and attention, but no representation or warranty, express or implied, is made as to the relevance, accuracy, completeness or fitness for purpose of this document in respect of any particular user's circumstances. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect of, their situation. The views expressed within are not necessarily the views of the Department of Environment and Climate Change NSW (DECC) and may not represent DECC policy.

TABLE OF CONTENTS

1.0 INTRODUCTION

The establishment of marine parks (MPs) in NSW is part of a program to institute a system of marine protected areas along the coast of NSW. This system forms part of the National Representative System of Marine Protected Areas.

These marine protected areas can provide a range of economic values to society including those associated with recreation and conservation. Hassall & Associates and Gillespie Economics (2004) outlined models for identifying these economic values and procedures for ongoing data collection and monitoring. One of the economic values identified in that report was the consumer surplus associated with recreation in MPs. Consumer surplus is the amount that visitors are willing to pay for the recreation experience above what they actually have to pay. One of the main methods for quantifying this value is the travel cost method (TCM) which is based on visitation data collected by questionnaire.

The Hassall & Associates and Gillespie Economics (2004) report provided a standard questionnaire for collecting travel cost data and this was implemented by the NSW Marine Parks Authority (MPA) for four MPs:

- Batemans Bay MP;
- Cape Byron MP;
- Jervis Bay MP; and
- Solitary Islands MP.

This study reports on the analysis of that visitation data using the zonal TCM.

2.0 OVERVIEW OF THE TCM

The TCM was developed conceptually by Harold Hotelling and reported by Prewitt in 1949 (Sinden and Worrell 1979; Bennett 1995 et al and Clawson and Knetsch 1966). The approach was subsequently modified and applied by Marion Clawson in 1959 (Bennett et al 1995). It has had widespread use since this time in valuing non-market recreation benefits.

The TCM can generally be thought of as comprising two steps. The first step is to examine the relationship between the rate of visitation to a site and the return costs of travelling to the site. This information can be used to define one point on the true demand curve for the subject site i.e. the number of visits to the site at the current nominal or zero price level (Hufschmidt et al 1983).

The visitation rate - travel cost relationship can then be used to estimate other points on the demand curve i.e. the number of visits that would be made to the site if varying levels of a hypothetical park fee were to be charged (Bennett et al 1995). This step allows the entire Marshallian or normal demand curve to be derived. The area under the demand curve estimates the consumers' surplus or economic benefit that accrues to the visitors to the site.

It is possible to analyse the travel cost - visitation relationship on the basis of zones (in which case the visitation rate per 1,000 population in the zone is compared to average marginal travel costs for that zone) or individuals (in which case the individuals travel costs are compared to the rate of visitation of the individual per year or other time period).

With the individual model, it is easier to include other explanatory variable such as income, age, education etc. However, with the individual model it is necessary for there to be some variability in the visitation rate of individuals. In many instances, this is not the case and so only the zonal model can be used.

3.0 SURVEY DESIGN AND IMPLEMENTATION

The survey design implemented by the MPA follows that suggested in Hassall & Associates and Gillespie Economics (2004) which follows the results of Bennett (1995). Bennett (1995) developed and implemented a comprehensive TCM questionnaire involving 18 detailed questions. These data were then used to facilitate a comparison between different economic models. It was found that four simple questions could provide sufficient information to yield reliable results in a more cost-effective, although this requires the adoption of some assumptions regarding travel time and opportunity cost of time rather than direct observation.

The simplified questionnaire covered:

- the group size;
- the age structure of the group (number of adults/children), the residential address (postcode)
- whether the visit is the sole purpose of the group's trip;
- if not, how important the groups visit is relative to other things they are doing on this trip.

Sampling for each MP was undertaken by the MPA over different periods of the year (e.g. summer/winter, during school holidays and outside school holidays) to account for seasonal variations in visitation and to be more representative of the annual visitation pattern.

4.0 RESULTS

4.1 Data Preparation and Zone Specification

Respondents were classified by the MPA into a constant set of zones. The goal in placing respondents into zones is to establish composite zones containing sufficient respondents, but which are also relatively homogenous in terms of distance from the MP and socioeconomic composition. Most guidelines suggest that each zone should have a minimum of 30 respondents. However, pragmatism often necessitates trade-offs between these goals (Whitten and Bennett 2001).

In undertaking this study, the original zone specification undertaken by MPA was adhered too, even though some zones had a smaller number of respondents than is desirable. However, sensitivity testing was undertaken for two of the demand models by amalgamating zones to get a greater number of respondents per zone. In both cases the consumer surplus estimate was less than 2.5% different from the original zone specification, indicating that the results are largely insensitive to zone specification and number of respondents per zone.

International respondents were unable to be included in the analysis since it was unclear where their point of origin was for their visitation to the MPs. This suggests a deficiency in the questionnaire design as it is currently not eliciting the starting point of international visitors for their visitation to the MPs. Amendment is required, especially since for some MPs the international visits were significant.

Zonal data for each MP are summarised in Appendix 1.

4.2 Travel and Time Costs

Travel costs from each zone are generally taken to be marginal travel costs (actual or perceived) , although sometimes average travel costs that include an allocation of insurance and maintenance costs have been used in TC studies. Still other studies have also included money spent at the site plus other money spent as part of the trip, for instance the “per visitor day costs of recreational supplies, fees for camp or trailer, sites and boat launching, fish bait, and extra cost of food, lodging, and other services beyond those that would be incurred at home” (Hufschmidt et al 1983, p219).

Marginal return travel costs from each zone were based on an average running costs of a medium car i.e. $0.20/km (RACV 2007) and average travel speeds of 70km/hr for intrastrate travel and 80km/hr for interstate travel (based on estimates from the NSW RTA Trip Time Calculator).

The base analysis undertaken for each MP incorporated marginal return travel costs only. However, the disutility of overcoming distance is not a function of money costs alone. Visitors to a site are faced with the dual constraint of time and direct money costs. Therefore, even if the money constraint were removed, less visitation from a more distant zone compared to a closer zone, would be expected (Lockwood and Tracy 1995). Therefore, it can be argued that it is important to include in the cost of time in the travel cost method (Hufschmidt et al 1983). To ignore time would lead to the derivation of a demand curve that underestimates consumers’ surplus or total benefits to the consumer from recreation on the site (Hufschmidt et al 1983; Bockstael et al 1987; Cesario 1976).

Modelling for each MP was therefore also undertaken including an opportunity cost of travel time. While there is considerable debate in the literature regarding an appropriate value, this study follows Rolfe and Dyack (unpublished) who apply a notional value of 50% of the full wage rate for adult travel time.

The standard travel cost model assumes that the visit to the site is the sole purpose of the trip. If, however, this is not the case then the TCM will overestimate the net benefit to the consumer from the visit. In practice, it is likely that for recreators there are "economies in combining visits to a number of recreation activities on the one trip" (Ulph and Reynolds 1981, p 203). Indeed, the further a zone is from the site being evaluated the greater is the chance of intervening recreation opportunities (Sinden and Worrell 1979). There are a number of approaches that may be used to apportion travel costs, although none has universal acceptance and the best approach needs to be assessed on a case by case basis.

Following (Bennett 1995) travel costs (and opportunity costs of people's time) were apportioned based on whether the visit to the MP was the primary purpose of the group's trip. If the trip was the sole purpose of the trip then 100% of costs were included. Where the visit to the MP was not the sole purpose of trip, costs were allocated based on how important the visit to the MP was to the groups overall trip i.e. 50% if the visit was identified by the respondent as "very important", 33% if "somewhat important", 25% if "a little important" and 20% if "not very important".

4.3 Functional Form

The selection of functional form for the travel cost - visitation rate relationship and specification of the demand curve is an important point because:

- selection of an appropriate functional form may reduce heteroscedasticity that is apparent in zonal models[1]; and
- inappropriate functional form can lead to distorted estimates of consumers' surplus (Darvall 1990).

Nevertheless, there is little guidance offered on selection of the correct form of a demand function or for that matter the travel cost - visitation rate relationship. Instead, selection of functional form is generally based on the statistical significance of the different functional forms (Darvall 1990).

Because different functional forms can result in very different consumer surplus estimates this study applies a consistent functional form across all travel cost-visitation rate relationships and demand curves. A double log function form was considered to provide the best statistical fit.

[1] Using the log of the dependent variable minimises heteroscedasticity (Whitten and Bennett 2001).

4.4 Visitation Rate – Travel Cost Relationship

The visitation rate – travel cost relationship for each MP are graphed in Appendix 2 while the regression results are summarised in Tables 4.1 and 4.2

Table 4.1 - Travel Cost-Visitation Rate Relationship (Excluding Time Cost)

		Coefficients	P-value	R Squared
Batemans Bay	Intercept	6.50	2.89E-06	0.73
	LN TC per person	-1.68	1.14E-05	
Cape Byron	Intercept	3.78	1.15E-02	0.41
	LN TC per person	-0.74	1.82E-02	
Jervis Bay	Intercept	5.11	5.60E-07	0.78
	LN TC per person	-1.26	2.58E-06	
Solitary Islands	Intercept	4.01	1.34E-04	0.66
	LN TC per person	-1.00	1.20E-04	

Table 4.2 - Travel Cost-Visitation Rate Relationship (Including Time Cost)

		Coefficients	P-value	R Squared
Batemans Bay	Intercept	7.69	2.46E-05	0.65
	LN TC per person	-1.60	7.63E-05	
Cape Byron	Intercept	4.66	1.44E-02	0.40
	LN TC per person	-0.79	2.11E-02	
Jervis Bay	Intercept	6.58	3.27E-07	0.80
	LN TC per person	-1.38	1.27E-06	
Solitary Islands	Intercept	4.95	2.75E-04	0.62
	LN TC per person	-1.02	2.73E-04	

In all cases the intercept and travel cost coefficient were highly significant and R-squared ranged from 0.40 to 0.80. These travel cost-visitation rate relationships were then used to establish the visitation pattern, if the fee associated with visiting the park were increased in $5 increments (i.e. a demand curve) up to a cut-off level of $100.

4.5 Demand Curves

These demand curves are graphed in Appendix 2 and the regression results reported in Tables 4.3 and 4.4.

Table 4.3 – Demand Curves (Excluding Time Cost)

		Coefficients	P-value	R Squared
Batemans Bay	Intercept	18.56	2.95E-09	0.79
	LN TC per person	-1.70	7.01E-08	
Cape Byron	Intercept	54.40	8.71E-08	0.76
	LN TC per person	-5.12	2.30E-07	
Jervis Bay	Intercept	22.08	6.09E-10	0.83
	LN TC per person	-1.98	9.25E-09	
Solitary Islands	Intercept	30.22	1.51E-12	0.92
	LN TC per person	-2.92	1.24E-11	

Table 4.4 – Demand Curves (Including Time Cost)

		Coefficients	P-value	R Squared
Batemans Bay	Intercept	28.88	1.01E-07	0.74
	LN TC per person	-2.63	6.39E-07	
Cape Byron	Intercept	72.17	7.32E-07	0.71
	LN TC per person	-6.78	1.45E-06	
Jervis Bay	Intercept	27.77	3.11E-08	0.76
	LN TC per person	-2.48	2.25E-07	
Solitary Islands	Intercept	39.28	2.59E-12	0.91
	LN TC per person	-3.76	1.28E-11	

Again the intercept and visits coefficient were highly significant with R-squareds ranging from 0.71 to 0.92.

4.6 Consumer Surplus Estimates

The area under the demand curve for each MP was then estimated. Because a double log function form was used it was necessary to truncate the demand curves. This was undertaken at $100 entry fee and at current conservative estimates of visitation levels for each MP i.e.:

- Batemans Bay MP – 52,000;
- Cape Byron MP – 40,000;
- Jervis Bay MP – 58,000;
- Solitary Islands MP – 32,000.

The average consumer surplus per visitor to each MP is provided in Table 4.5 for demand curves that only include vehicle travel costs and also for demand curves that include travel time. Annual values for recreation use of the MPs are also provided by multiplying average values per person by the estimated annual visitation.

Table 4.5 – Economic Value of Visits to Protected Areas in North East NSW

Protected Area	CS/Visit Vehicle Costs Only	CS/Visit Vehicle Costs and Time Costs	Annual Recreation Values (Lower)	Annual Recreation Values (Upper)
Batemans Bay Marine Park	$15.79	$30.96	$821,080	$1,609,920
Cape Byron Marine Park	$49.59	$62.39	$1,983,600	$2,495,600
Jervis Bay Marine Park	$21.85	$32.34	$1,267,300	$1,875,720
Solitary Islands Marine Park	$31.41	$42.23	$1,005,120	$1,351,360

5.0 CONCLUSION

Like terrestrial protected areas, marine protected areas have a range of economic values including those associated with recreation use. These recreation values are amenable to estimation using the simple zonal TCM.

Estimates of recreation use values for four MPs in NSW range from $16 to $50 when opportunity costs of time were excluded and from $31 to $62 when these costs were included at 50% of the gross hourly wage rate.

Recreation values per visit were greatest for Cape Byron MP and least for Batemans Bay MP while annual recreation values which also take into account annual visitation were greatest for Cape Byron MP, $2.5M pa, and least for Solitary Islands MP, $1.4M pa.

Prior to any future recreation value studies for NSW MPs, it is recommended that the simple zonal travel cost questionnaire used for this study be amended to ensure that data on international visitors is able to be included in the analysis. This would involve rewording of the "usual place of residence" question so that international visitors identify where they have come from on the particular trip that brings them to the MP, rather than identifying their country of origin.

6.0 REFERENCES

Bennett, J. (1995) *The Travel Cost Method of Estimating the Value of Recreational Use of Natural Areas: An Application Manual*, prepared for NSW NPWS.

Bennett, J., Gillespie, R., Powell, R. and Chalmers, L., 1995, *The Economic Value and Regional Economic Impact of National Parks*, Ecological Economics Conference, Conference Papers, The Australian and New Zealand Society for Ecological Economic in association with the Centre for Agricultural and Resource Economics.

Bockstael, N., Strand, I., and Hanemann, M. 1987, *Time and the Recreational Demand Model*, American Journal of Agricultural Economics, Vol. 69, pp. 293-302.

Cesario, F. J. 1976, Value of Time in Recreation Benefit Studies, *Land Economics*, Vol. 52(1):32-41.

Clawson, M. and Knetsch, J. 1966, *Economics of Outdoor Recreation*, John Hopkins University Press, Baltimore and London.

Darvall, D. 1990, *An Assessment of the Travel Cost Method of Valuing Recreation Benefits: A Case Study of the Ovens and King River System*, Thesis presented in partial fulfillment of the requirements for the degree of Bachelor of Agricultural Economics, University of New England.

Gillespie, R. (1997) *The Economic Value and Regional Economic Impact of Minnamurra Rainforest Centre, Budderoo National Park*, NSW National Parks and Wildlife Service, Environmental Economics Series.

Hassall & Associates and Gillespie Economics (2004) *Economic values of NSW Marine Parks - models for identifying economic values, and developing procedures for on-going data collection and monitoring*, prepared for NSW Marine Park Authority.

Hufschmidt, M., James, D., Meister, A., Bower, J. 1983, *Environment, Natural Systems, and Development: An Economic Valuation Guide*, John Hopkins University Press, Baltimore and London.

Lockwood, M. and Tracy, K. 1995, Non-market Valuation of an Urban Recreation Park, *Journal of Leisure Research*, Vol. 27, No. 2, pp. 155 - 167.

NSW RTA Trip Time Calculator http://www.rta.nsw.gov.au/cgi-bin/index.cgi?action=fatiguecalc.form

RACV (2007) http://www.racv.com.au/wps/wcm/connect/Internet/Primary/my+car/advice+%26+information/car+operating+costs/medium+cars

Rolfe, J. and Dyack, B. (unpublisehd) *Recreation Values of Barmah Forest and the Coorong region*

Sinden, J. and Worrell, A. 1979, *Unpriced Values: Decisions without Market Prices*, John Wiley and Sons, Toronto.

Sinden, J. and Worrell, A. 1979, *Unpriced Values: Decisions without Market Prices*, John Wiley and Sons, Toronto.

Ulph, A. and Reynolds, I. 1981, *An Economic Evaluation of National Parks*, Centre for Resource and Environmental Studies, Australian National University, Canberra.

Whitten, S. and Bennett, J. (2001) *A travel cost study of duck hunting in the Upper South East of South Australia*, Private and Social Values of Wetlands Research Report No. 7.

APPENDICES

Appendix 1 –Zone Data for Each Marine Park

Table A1.1 – Zone Data for Batemans Bay Marine Park

Zone	No. of Groups	Sample Visits	Annual Visits	Popn.	Annual Visits per (000) Popn	Return Distance (km)	Apportioned Vehicle Costs per Person	Apportioned Total Travel Cost per Person
ACT	103	346	14,808	311,947	47.5	232	9	25
Central Coast	9	24	1,027	786062	1.3	684	26	63
Inland NE	10	29	1,241	324935	3.8	938	45	116
Inland NW	1	2	86	147786	0.6	1014	33	79
Inland SE	26	100	4,280	232356	18.4	422	16	50
Inland SW	6	21	899	111140	8.1	856	30	89
North coast	7	17	728	524785	1.4	1416	46	119
QLD (SE)	6	15	642	2,372,104	0.3	1992	85	211
SA	4	10	428	1,467,261	0.3	2104	64	160
South Coast	109	265	11,342	149174	76.0	84	4	10
Southern Highlands	2	3	128	42323	3.0	312	8	17
Southern Tablelands	11	29	1,241	52757	23.5	272	15	37
Sydney	68	203	8,688	3609597	2.4	482	19	50
Tas	1	2	86	456,652	0.2	1622	81	178
Victoria	30	91	3,895	4,644,950	0.8	1000	37	86
WA	4	12	514	1,851,252	0.3	6276	180	407
Wollongong	15	46	1,969	254804	7.7	344	12	29
Total	**412**	**1215**	**52000**		**47.5**			

Table A1.2 – Zone Data for Cape Byron Marine Park

Zone	No. of Groups	Sample Visits	Annual Visits	Popn.	Annual Visits per (000) Popn	Return Distance (km)	Apportioned Vehicle Costs per Person	Apportioned Total Travel Cost per Person
ACT	3	5	633	311,947	2.0	1702	143	305
Central Coast	1	2	253	786062	0.3	1056	53	125
Inland NE	2	6	759	324935	2.3	944	21	63
Inland SE	2	3	380	232356	1.6	1854	192	388
North coast	77	174	22,025	524785	42.0	326	15	34
QLD (SE)	11	29	3,671	2,372,104	1.5	334	14	33
SA	3	6	759	1,467,261	0.5	3138	262	573
South Coast	4	9	1,139	149174	7.6	1656	73	185
Sydney	20	42	5,316	3609597	1.5	1260	81	186
Tasmania	1	1	127	456,652	0.3	3358	672	1071
Victoria	11	25	3,165	4,644,950	0.7	2586	123	278
WA	3	5	633	1,851,252	0.3	7266	523	1042
Wollongong	3	9	1,139	254804	4.5	1396	78	236
Total	**141**	**316**	**40000**					

Table A1.3 – Zone Data for Jervis Bay Marine Park

Zone	No. of Groups	Sample Visits	Annual Visits	Popn.	Annual Visits per (000) Popn	Return Distance (km)	Apportioned Vehicle Costs per Person	Apportioned Total Travel Cost per Person
ACT	21	34	3,176	311,947	10.2	296	23	46
Blue Mts	4	16	1,494	89203	16.8	316	10	23
Central Coast	3	6	560	786062	0.7	476	15	36
Inland NE	3	7	654	324935	2.0	760	18	36
Inland NW	2	7	654	147786	4.4	944	18	39
Inland SE	1	1	93	232356	0.4	520	104	175
Inland SW	2	4	374	111140	3.4	936	40	94
North coast	5	13	1,214	524785	2.3	1206	55	104
NT	1	1	93	210664	0.4	6540	262	417
QLD (SE)	5	15	1,401	2,372,104	0.6	1788	39	80
SA	2	4	374	1,467,261	0.3	2204	132	290
South Coast	64	139	12,982	149174	87.0	128	6	13
Southern Highlands	5	21	1,961	42323	46.3	140	3	8
Sydney	65	214	19,987	3609597	5.5	276	9	27
Victoria	10	21	1,961	4,644,950	0.4	1182	45	102
WA	1	2	187	1,851,252	0.1	6476	324	709
Wollongong	23	116	10,834	254804	42.5	140	3	8
Total	**217**	**621**	**58000**					

Table A1.4 – Zone Data for Solitary Islands Marine Park

Zone	No. of Groups	Sample Visits	Annual Visits	Popn.	Annual Visits per (000) Popn	Return Distance (km)	Apportioned Vehicle Costs per Person	Apportioned Total Travel Cost per Person
ACT	3	10	394	311,947	1.3	1404	40	83
Blue Mts	1	4	157	89203	1.8	976	49	115
Central Coast	6	16	630	786062	0.8	752	25	60
Inland NE	9	23	905	324935	2.8	690	37	86
Inland NW	2	4	157	147786	1.1	1268	53	124
Inland SW	3	7	276	111140	2.5	1796	47	122
North coast	135	485	19,090	524785	36.4	36	1	3
QLD (SE)	19	62	2,440	2,372,104	1.0	606	20	48
SA	6	12	472	1,467,261	0.3	2932	160	351
South Coast	6	12	472	149174	3.2	1350	80	181
Southern Highlands	1	5	197	42323	4.7	1138	46	107
Sydney	36	123	4,841	3609597	1.3	956	37	103
TAS	2	6	236	456,652	0.5	3246	216	474
Victoria	13	37	1,456	4,644,950	0.3	2300	104	240
WA	1	1	39	1,851,252	0.0	7112	356	567
Wollongong	3	6	236	254804	0.9	1090	45	107
Total	**246**	**813**	**32000**					

Appendix 2 – Travel Cost Visitation Rate Relationships

Figure A2.1 – Travel Cost – Visitation Rate Relationship for BBMP (Excluding Time Cost)

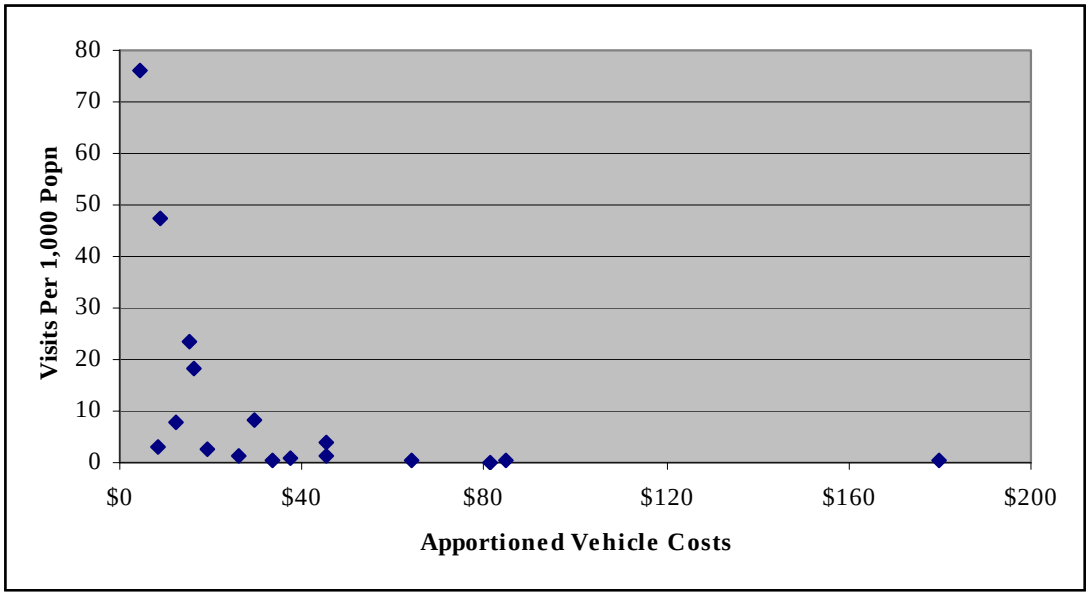


Figure A2.2 – Travel Cost – Visitation Rate Relationship for BBMP (Including Time Cost)

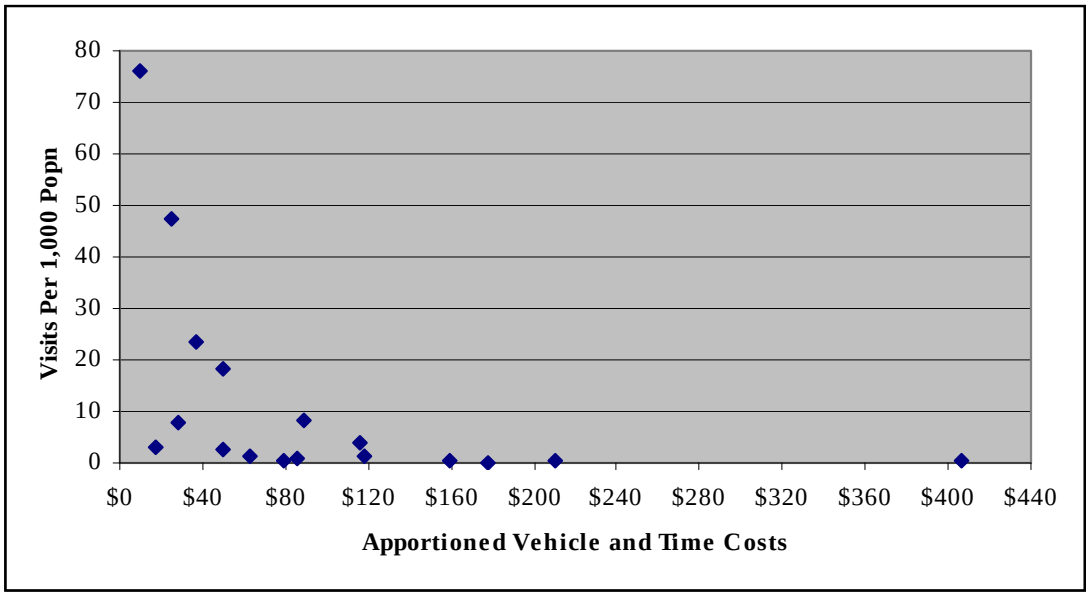


Figure A2.3 – Travel Cost – Visitation Rate Relationship for CBMP (Excluding Time Cost)

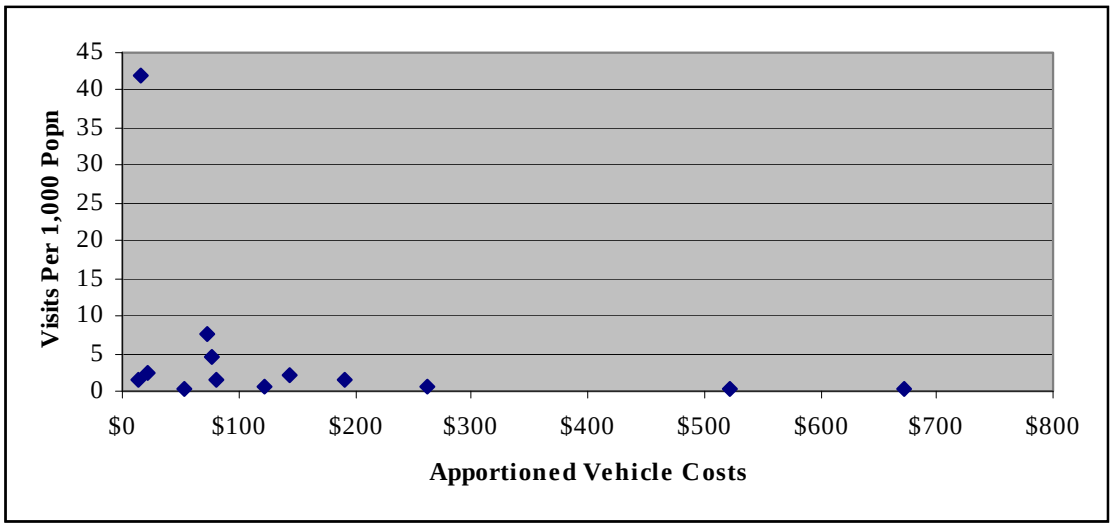


Figure A2.4 – Travel Cost – Visitation Rate Relationship for CBMP (Including Time Cost)

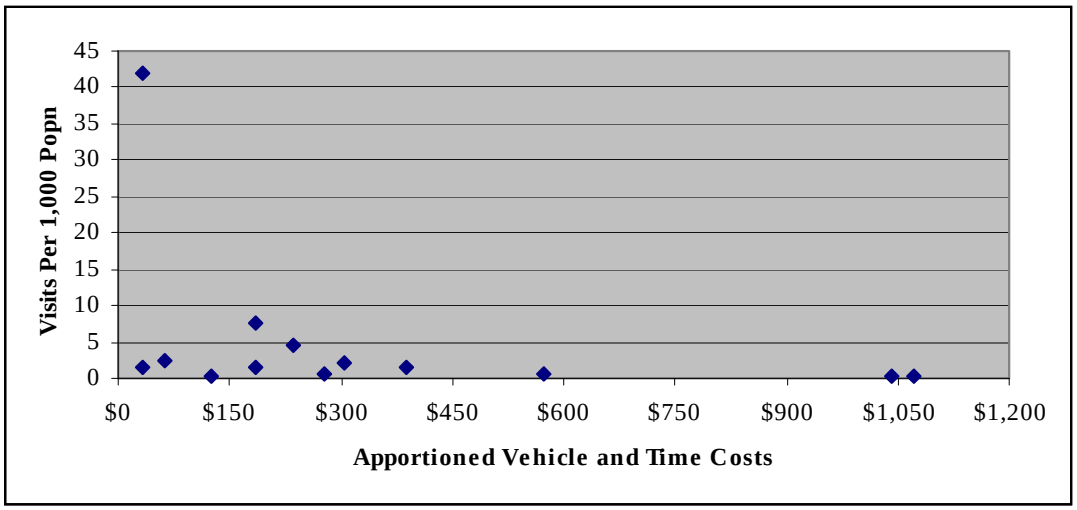


Figure A2.5 – Travel Cost – Visitation Rate Relationship for JBMP (Excluding Time Cost)

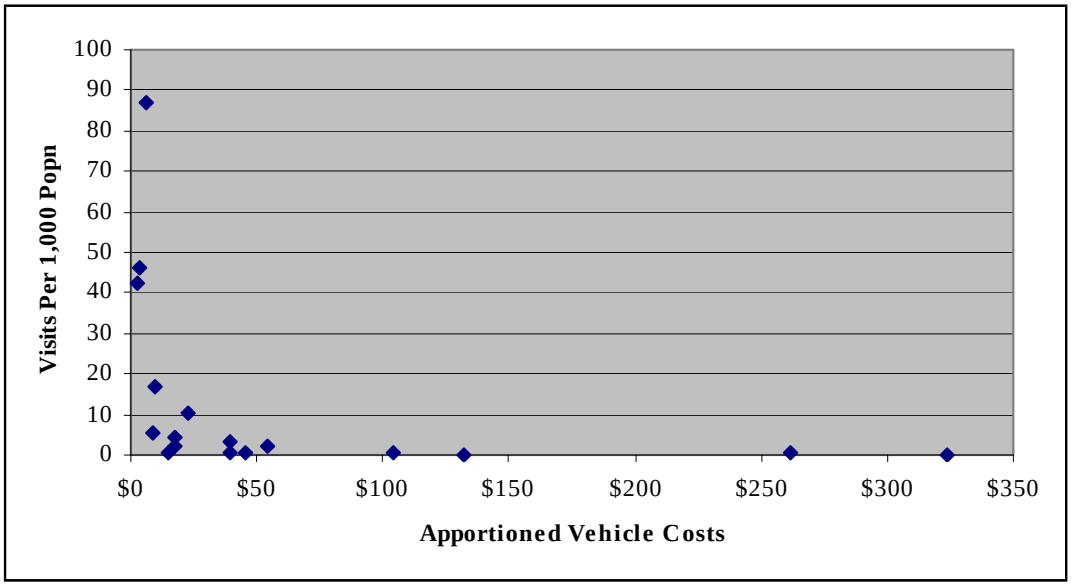


Figure A2.6 – Travel Cost – Visitation Rate Relationship for JBMP (Including Time Cost)

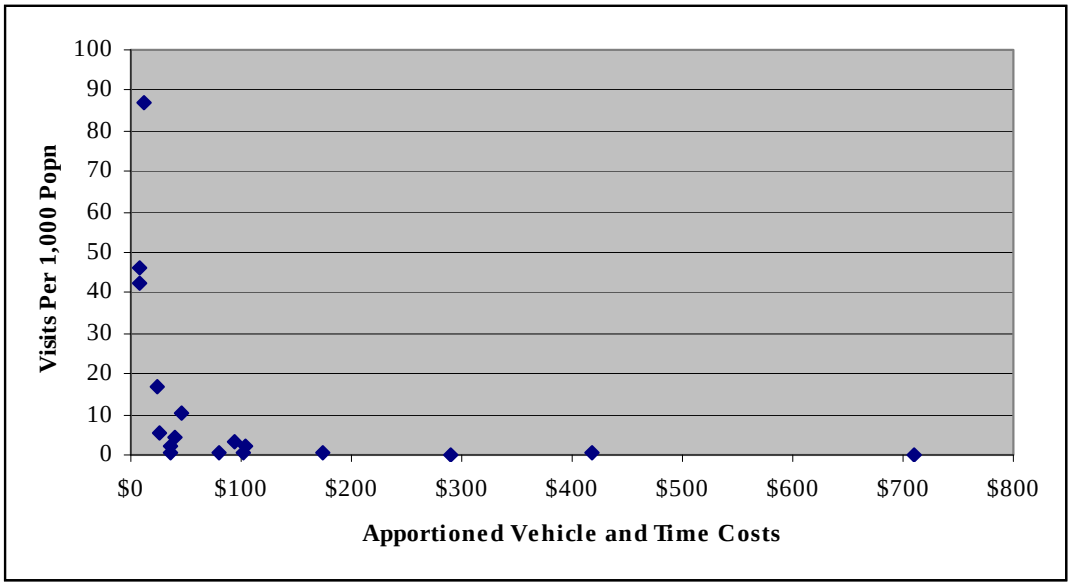


Figure A2.7 – Travel Cost – Visitation Rate Relationship for SIMP (Excluding Time Cost)

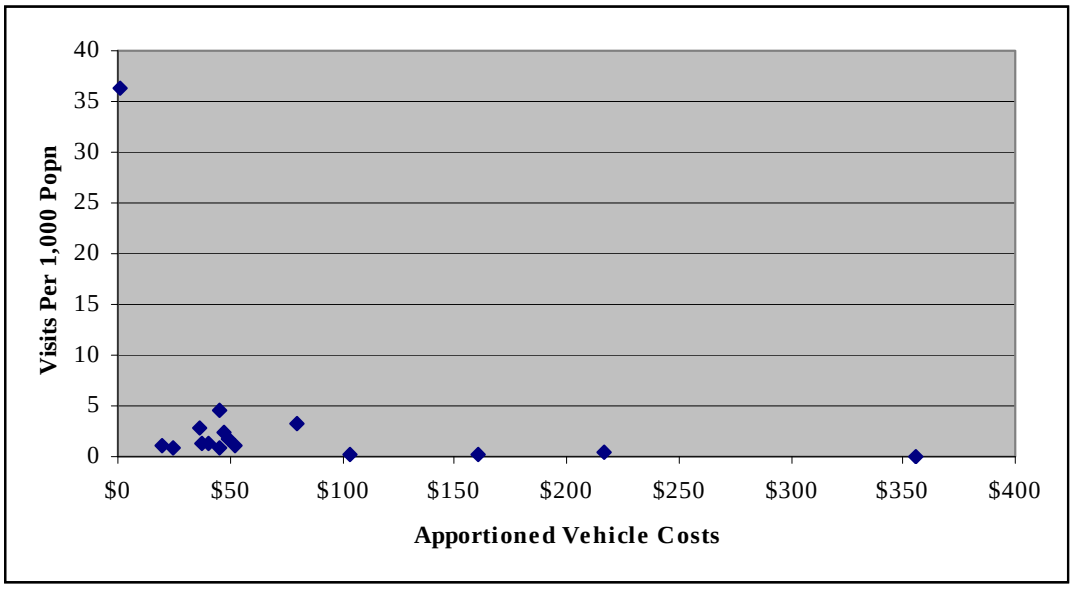
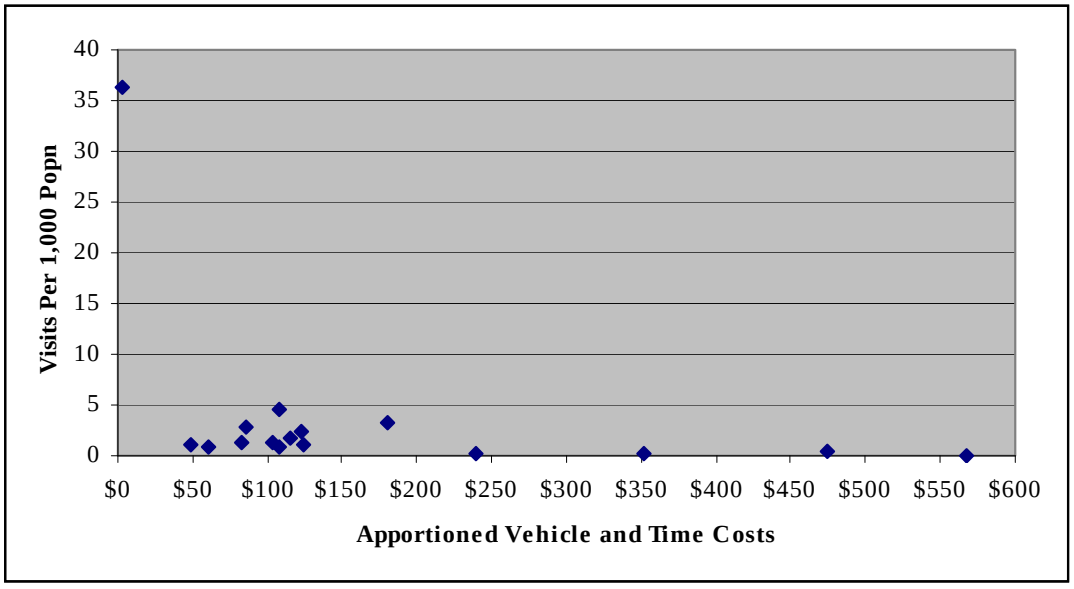


Figure A2.8 – Travel Cost – Visitation Rate Relationship for SIMP (Including Time Cost)



Appendix 3 – Demand Curves

Figure A3.1 – Demand Curve for BBMP (Excluding Time Cost)

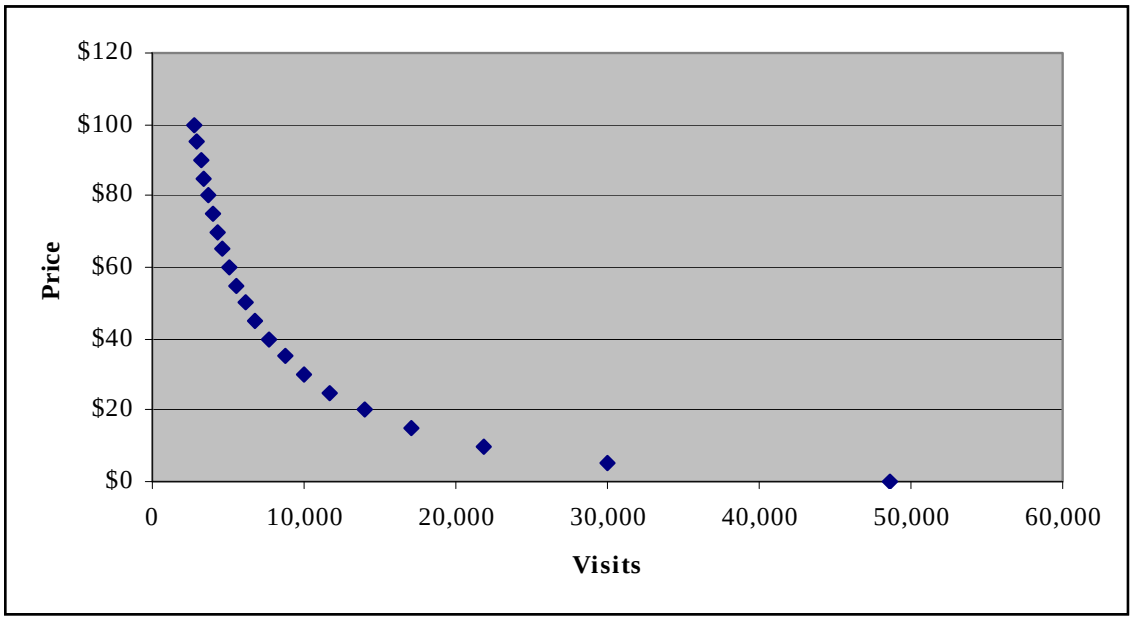


Figure A3.2 – Demand Curve for BBMP (Including Time Cost)

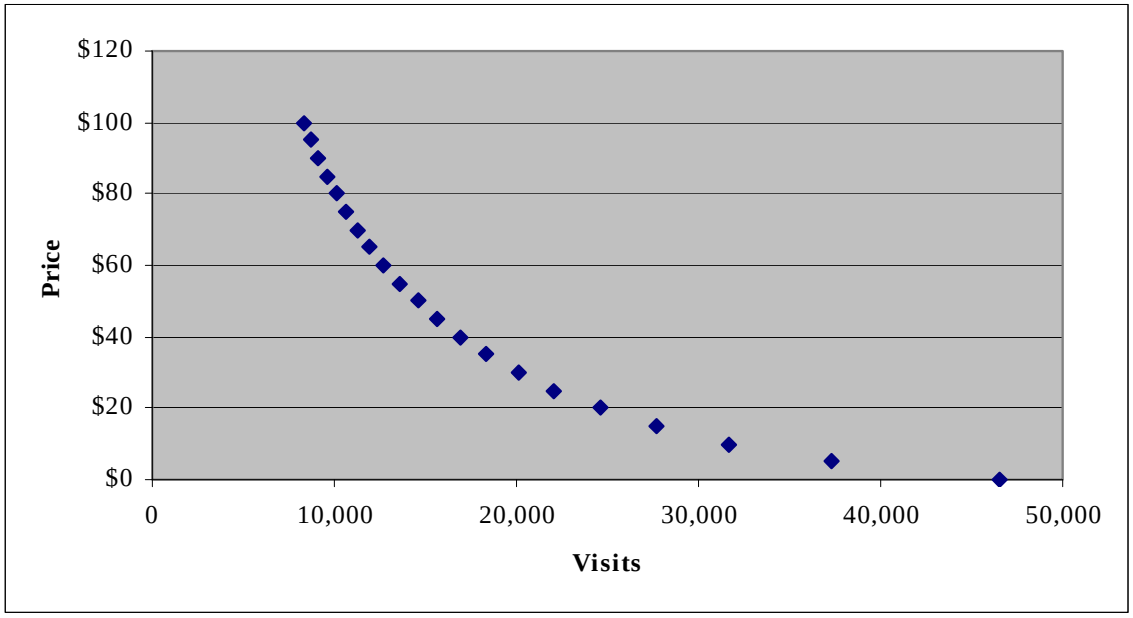


Figure A3.3 – Demand Curve for CBMP (Excluding Time Cost)

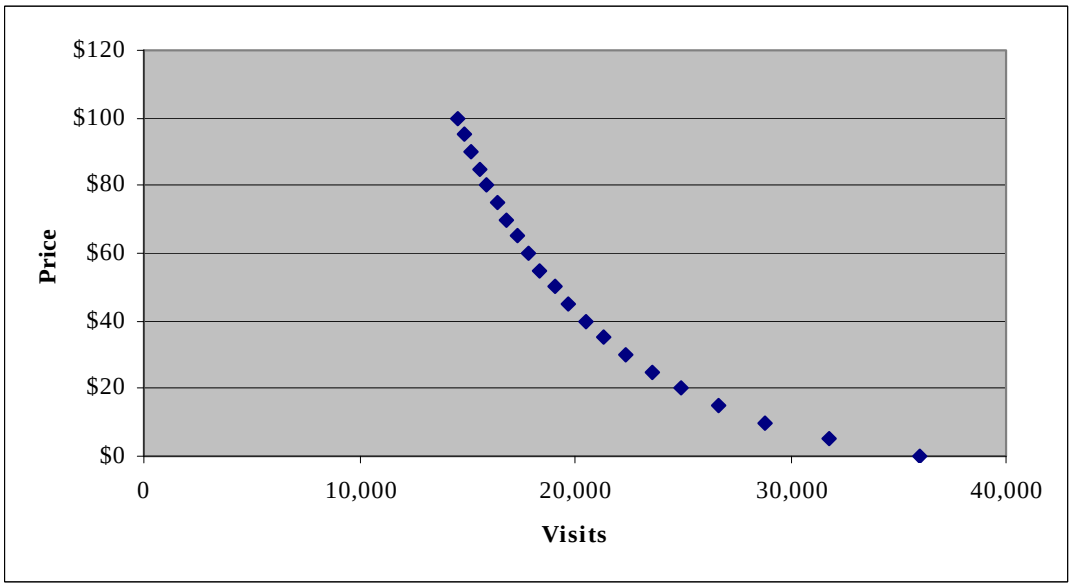


Figure A3.4 – Demand Curve for CBMP (Including Time Cost)

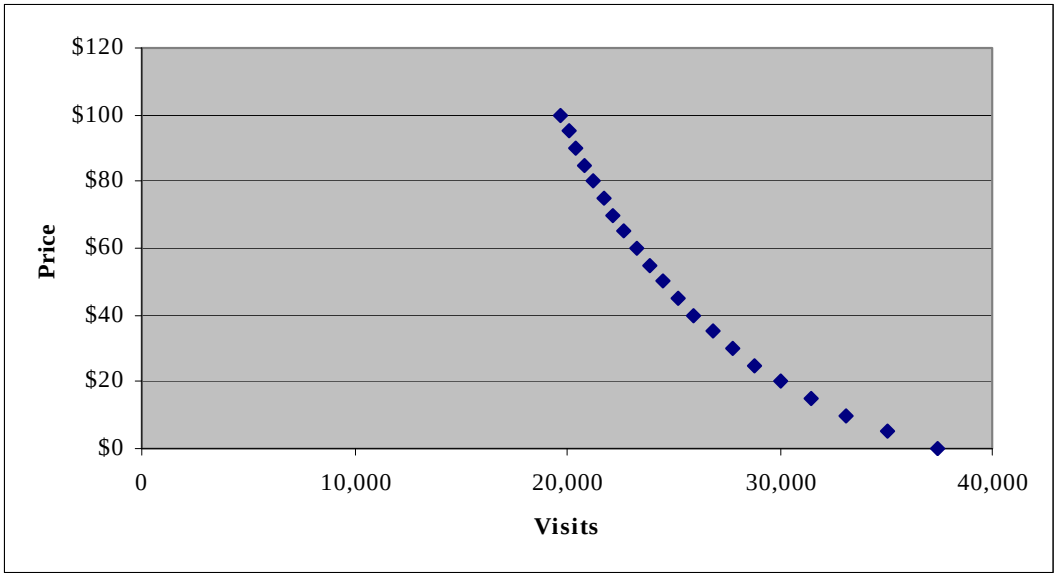


Figure A3.5 – Demand Curve for JBMP (Excluding Time Cost)

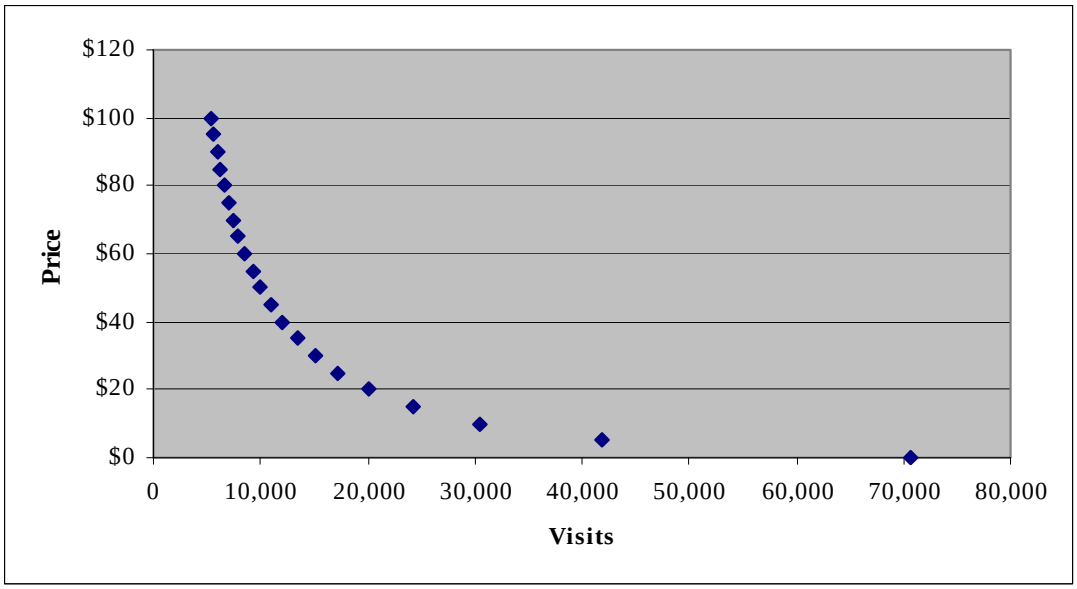


Figure A3.6 – Demand Curve for JBMP (Including Time Cost)

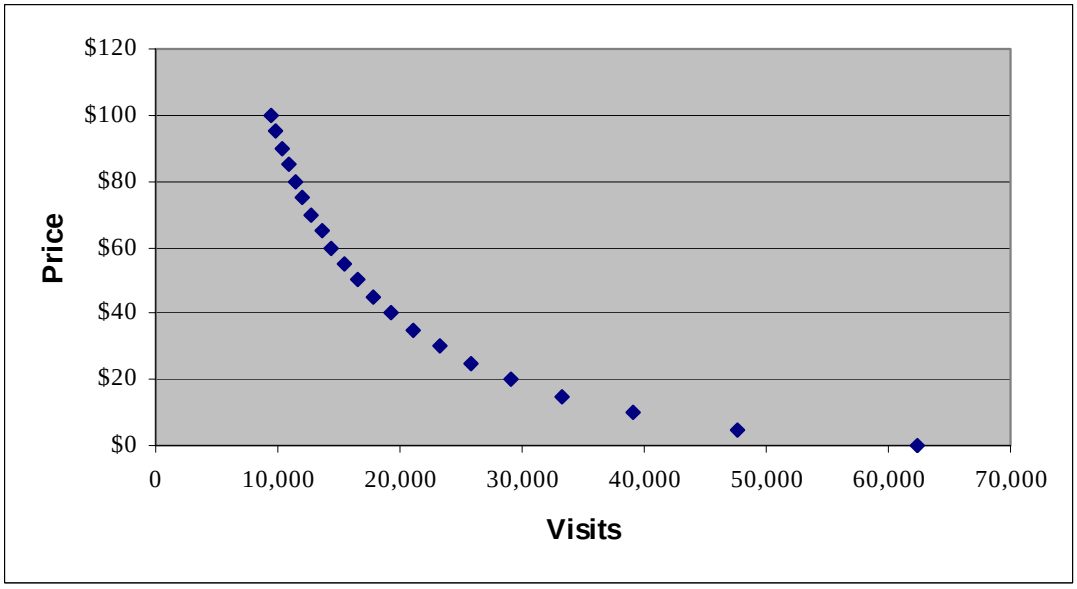


Figure A3.7 – Demand Curve for SIMP (Excluding Time Cost)

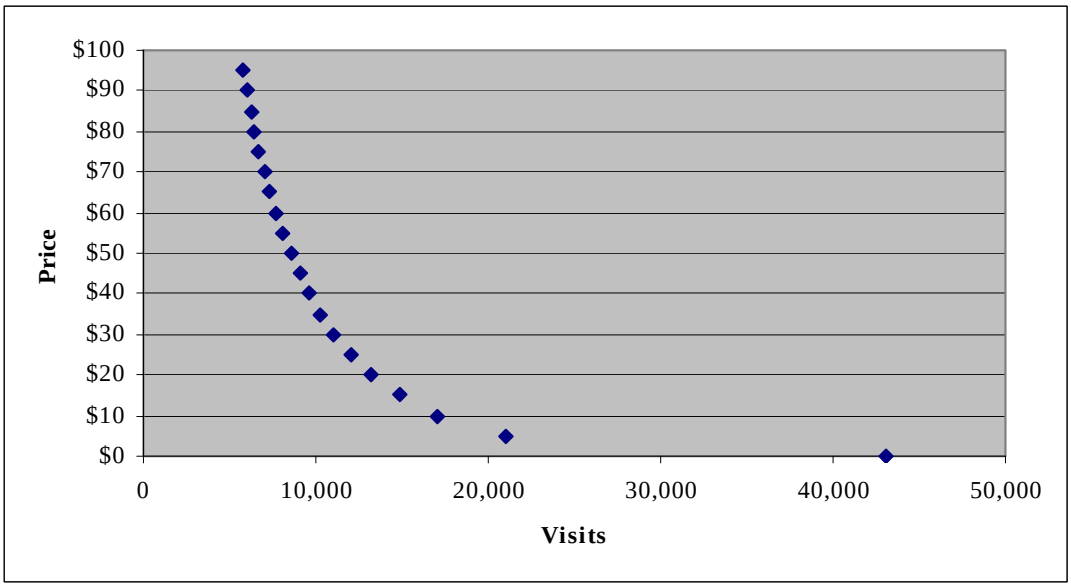


Figure A3.8 – Demand Curve for SIMP (Including Time Cost)