## BTE Publication Summary

# Road Construction Price Indexes 1977/78 to 1987/88

## **Information Paper**

This Information Paper presents input-price indexes for national road construction activity for the period 1977-78 to 1987-88. This is part of a series which commenced in 1969-70.





### bureau of transport and communications economics

**Information Paper 32** 

## Road Construction Price Indexes 1977-78 to 1987-88

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#### FOREWORD

This information Paper presents the BTCE input-price indexes for national road construction activity for the period 1977-78 to 1987-88. Earlier values of the indexes can be found in BTE Report 49, and subsequent Information Papers.

The BTCE total activity index comprises three sub-indexes relating to maintenance, State road authority construction, and Local Government Authority road construction. Each of these sub-indexes contains six input-price components: salaried labour; other labour; fuel; bitumen; other materials; and plant acquisition and replacement. The BTCE indexes provide up-to-date information on price movements for inputs to road construction in Australia as a whole.

The Paper was prepared by Mr K.Y. Loong and Mr M.G. O'Halloran.

M. Haddad Director

Bureau of Transport and Communication Economics Canberra May 1989

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#### SUMMARY

The BTCE road construction price indexes are input-price indexes designed to reflect trends in prices of major input components of road construction using, where possible, nation-wide information.

Figure 1 shows the overall movement of the BTCE road construction price index for total activity. The BTCE overall activity index recorded an increase in 1987-88 of 5.7 per cent, slightly higher than the previous year's increase of 4.6 per cent.

The State Rail Authority (SRA) construction sub-index, the Local Government Authority (LGA) construction sub-index and the maintenance sub-index showed increases of 5.9 per cent, 5.8 per cent and 5.2 per cent respectively in 1987-88. These increases in the sub-indexes, as with the total activity index, were higher than the 1986-87 increases. The larger movements for 1987-88 are mainly the result of an 11.0 per cent increase in the price of the bitumen component. The SRA construction sub-index, the LGA construction sub-index, the maintenance sub-index and the total activity index for 1977-78 to 1987-88 are shown in Table 1.

Of the input components, salaried labour, other labour and fuel all recorded the smallest percentage increase since 1978, with rises of 6.3 per cent, 3.9 per cent and 1.5 per cent respectively. The 1.5 per cent increment of the fuel component is largely a reflection of the depressed world prices for crude oil. The bitumen component's price rise



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Figure 1 BTCE road construction price index (total activity), 1977-78 to 1987-88

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(Base	e year 1979-80ª	, adjusted so	that 1969-70	= 100)
Year	State road	Local government		
ended	authority	authority		Overall
30 June	construction	construction	Maintenance	activity
1978	260.3	258.7	263.7	260.9
1979	280.7	279.2	285.5	281.8
1980	325.1	324.6	330.3	326.7
1981	376.1	375.9	380.1	377.4
1982	424.8	424.2	428.0	425.8
1983	476.5 <sup>r</sup>	476.5 <sup>r</sup>	484.7 <sup>r</sup>	<b>4</b> 79.4 <sup>1</sup>
1984	507 <b>.</b> 4 <sup>r</sup>	506.6 <sup>r</sup>	515.9 <sup>r</sup>	510.11
1985	535.8 <sup>r</sup>	535.3 <sup>r</sup>	545.3 <sup>r</sup>	539.0 <sup>1</sup>
1986	576.1 <sup>r</sup>	577.0 <sup>r</sup>	583.6 <sup>r</sup>	57 <b>8.</b> 81
1987	602.0 <sup>r</sup>	603.3 <sup>r</sup>	610.9 <sup>r</sup>	605.6 <sup>1</sup>
1988	637.7	638.4	642.7	639.8

 

 TABLE 1
 BTCE ROAD CONSTRUCTION PRICE INDEXES, 1978 TO 1988

 (Decension and the second construction of th

a. The overall activity index and the sub-indexes were derived for the base year 1979-80 and then scale adjusted to give 1969-70 = 100.0, to facilitate comparison.

r Revisions to the index values presented in Information Paper 23 (BTE 1987) resulting from updated information.

of 11.0 per cent is in contrast to its 1986-87 fall of 8.9 per cent. Other materials and plant acquisition and replacement, saw gains of 8.8 per cent and 6.6 per cent respectively in 1987-88.

The BTCE indexes are designed to allow road construction organisations to monitor price movements of inputs to road construction and maintenance. The individual input components are provided to allow detailed interpretation of the BTCE indexes, and to enable those involved in road construction and maintenance to use the component indexes for their own purposes.

It should be noted that the BTCE road construction price indexes are input-price indexes and, as such, do not measure movements in the actual cost of provision of roads nor reflect changes in productivity. xiii

#### CHAPTER 1 INTRODUCTION

#### ORIGIN OF THE STUDY

Road construction and maintenance is carried out in Australia by Federal, State and local governments. Road construction price indexes provide important data for evaluating changes in road expenditures and funding levels.

In the past, a range of indexes has been provided by a number of agencies. However, the most significant work in this area was that undertaken by the former Commonwealth Bureau of Roads (CBR). The bulk of this work was related to the analysis of road investment. Following the amalgamation of the CBR with the Bureau of Transport Economics (BTE) in 1976, the BTE has continued to undertake economic and financial evaluations of the Australian road system.

As an input into the 1979 road study report (BTE 1979), the BTE developed and published a set of road construction price indexes (Burke 1978). Since then, there have been a number of BTE publications updating the indexes (BTE 1983, 1984, 1985a, 1985b, 1986 and 1987). This work is being continued by the Bureau of Transport and Communications Economics (BTCE) which was renamed as part of the amalgamation in July 1987 of the former Departments of Transport, Aviation and Communications.

#### **OBJECTIVES OF THE STUDY**

The objective of this study is to provide those involved in road construction and maintenance with a series of aggregated national price indexes, so that expenditure information can be examined in real terms.

The BTCE road construction price indexes may not fully satisfy the particular requirements of those seeking indexes for project planning and cost control. However, the individual input component indexes are provided in this study to allow detailed interpretation of the aggregated indexes, and to enable those involved with road construction and maintenance to apply the component indexes to their own work programs.

#### STRUCTURE OF THE PAPER

The BTCE road construction price indexes are presented in Chapter 2 and their structure, basic input components and the weighting combinations used in their calculation are described. The chapter also details the movements through time of the input components and the movements of the resultant BTCE indexes and compares the BTCE indexes with other road construction price indexes.

Appendix I outlines the different types of road construction indexes which are in use and discusses the advantages and disadvantages of each. The major road construction indexes produced by the State road authorities, and the indexes developed by the former CBR and the BTE are also described.

Appendix II details the current sources of the input components.

#### CHAPTER 2 THE BTCE ROAD CONSTRUCTION PRICE INDEXES

#### STRUCTURE OF THE INDEXES

The BTCE road construction price indexes are input-price indexes designed to reflect trends in prices of major input components of road construction using, where possible, nation-wide information.

A wide range of cost and price indexes can be developed for road construction activity and these are outlined in Appendix I. Given that the information required to construct an output-cost index for road construction activity is not currently available in an appropriate form, an input-price index has been constructed. This index type does not include changes in productivity for road construction activity, nor does it measure the actual cost of the provision of or maintenance of roads.

To derive the BTCE price index, road construction activity is divided into three sectors:

- . construction by State Road Authorities (SRAs) originally based on information received from two SRAs;
- . construction by Local Government Authorities (LGAs) originally based on information received from 250 LGAs; and
- maintenance activity originally based on maintenance work undertaken by both SRAs and LGAs.

The SRA, LGA and maintenance sub-indexes are compiled from six common input components and differ according to the component weighting scheme allocated to each. The six common input components are: salaried labour, other labour, fuel, bitumen, other material, and plant acquisition and replacement.

The weights for each of the six input components remain fixed for the span of the index series. However, as each of the input components varies at different rates, the product of the varying component indexes and the fixed weights results in effective changes in the significance of each input component in the total activity index. (See Figures 2.1 and 2.2). Changes in the significance of inputs into the SRA, LGA and maintenance sub-indexes occur for the same reasons.

The BTCE index is a total activity index which represents the aggregated price movements in road construction activity for Australia as a whole. The BTCE index is compiled from the SRA, LGA and maintenance sub-indexes and uses the following weighting combination:

- . SRA construction sub-index, 35 per cent
- . LGA construction sub-index, 31 per cent
- . maintenance sub-index, 34 per cent.

Table 2.1 provides details of the weighting schemes. Further information regarding the derivation of the weights can be found in BTE(1981).

#### THE INPUT COMPONENTS FOR THE BTCE INDEX

There are six basic input components employed in the construction of the BTCE index.



ப



Per cent

\_\_\_\_\_

\_\_\_\_

		Construction			
				Total	
Component	Maintenance	SRA	LGA	activity	
Labour					
Salaried	15.9	22.8	20.4	19.7	
Other	44.1	32.1	32.1	36.1	
Total	60.0	54.9	52.5	55.8	
Materials					
Fuel	11.7	9.1	10.3	10.4	
Bitumen	6.2	9.3	9.4	8.3	
Other	14.6	20.9	18.2	17.9	
Plant acquisitio	on				
and replacement	7.5	5.8	9.6	7.6	
Total	100.0	100.0	100.0	100.0	
				_	

TABLE 2.1 COMPONENT WEIGHTS (estimated for base 1979-80) (per cent)

Source BTE (1981).

#### Salaried labour

This series is used to approximate movements in the cost of employing people engaged in non-manual work and whitecollar occupations. Data have been taken from the Australian Bureau of Statistics, Average Weekly Earnings, Australia (ABS 1988a). However, there have been changes in this time series. Originally, data were expressed in dollars per week, but this series was replaced by an employer survey index in 1981 and a linking factor has been used for continuity.

#### Other labour

This is a 'wage-earners' series, chosen to reflect movements in the cost of employing blue-collar workers and people engaged in manual work. The ABS Award Rates of Pay Indexes, Australia (ABS 1988b) have been used but, once again, there have been some changes to the data available. At the beginning of the series, data were in dollars per week, but these were replaced by an index in 1981. The wage earners series was terminated in 1987 and, after some discussion with the ABS, a wage and salary earners index was adopted and linking factors were calculated.

#### Fuel

Again there has been some discontinuity in available statistical information on fuel prices. The ABS supplied the original time series on diesel automotive distillate, an unpublished component of a statistical series 'Articles Produced by Manufacturing Industry' (ABS 1982). However, this series failed to reflect significant movements in fuel prices in 1980 and 1981 and was replaced by a series constructed from data obtained from the Petroleum Products Pricing Authority (PPPA). When the functions of the PPPA were transferred to the Prices Surveillance Authority in 1984, these data were no longer maintained. Therefore, a

new series has had to be used to measure movements in fuel prices. The series that is now used refers to the price of automotive fuel, a component of the transport group of the Consumer Price Index (ABS 1988c).

#### Bitumen

Data for this component are obtained from Shell Australia Ltd.

#### Other materials

These data are extracted from the ABS Publication, Price Index of Materials Used in Building Other Than House Building (ABS 1988e).

#### Plant acquisition and replacement

This is an unpublished component of Price Indexes of Articles Produced by Manufacturing Industry, Australia (ABS 1988d). It should be noted that these data refer only to Australian produced machinery and, therefore, no direct measure is included of the price of any imported machinery affected by foreign exchange rates.

For full details of current input component sources, see Appendix II.

#### MOVEMENTS IN THE PRICES OF INPUT COMPONENTS

Table 2.2 and Figures 2.1 to 2.4 provide details of the input component indexes.

#### Salaried Labour

The percentage increase for 1987-88 in the price of salaried labour was 6.3 per cent, the smallest increase to

## TABLE 2.2 COMPONENT INDEXES OF BTCE ROAD CONSTRUCTION PRICE INDEXES, INCLUDING PERCENTAGE CHANGES 1978 TO 1988

(Original base year 1979-80, adjusted so that 1969-70 = 100.0)

						Plant
Year		1				acquisition
ended	Salaried	Other			Other	and
30 June	labour <sup>a</sup>	labour <sup>b</sup>	Fuel <sup>c</sup>	Bitumen	materials	replacement
1978	274.6	290.6	232.9	272.8	226.0	215.8
	(9.9)	(9.1)	(21.0)	(7.2)	(8.4)	(8.9)
1979	295.7	309.7	308.7	274.7	242.6	228.1
	(7.7)	(6.6)	(32.5)	(0.7)	(7.3)	(5.7)
1980	324.9	336.9	497.4	380.8	274.2	252.1
	(9.9)	(8.8)	(61.1)	(38.6)	(13.0)	(10.5)
1981	369.1	373.9	631.8	512.4	309.7	281.5
	(13.6)	(11.0)	(27.0)	(34.6)	(12.9)	(11.7)
1982	422.7	420.5 <sup>r</sup>	697.8	606.9	344.0	311.1
	(14.5)	(12.5) <sup>r</sup>	(10.4)	(18.4)	(11.1)	(10.5)
1983	465.3	467.6	962.5	615.6	383.3	328.4
	(10.1)	(11.2)	(37.9)	(1.4)	(11.4)	(5.6)
1984	509.7 <sup>r</sup>	492.7	1 067.4	630.1 <sup>r</sup>	403.6	333.0
	(9.5) <sup>r</sup>	(5.4)	(10.9)	$(2.4)^{r}$	(5.5) <sup>r</sup>	(1.4)
1985	544.2 <sup>r</sup>	517.7	1 147.5	637.2 <sup>r</sup>	426.0 <sup>r</sup>	357.5
	(6.8) <sup>r</sup>	(5.1)	(7.5)	(1.1)	(5.6) <sup>r</sup>	(7.4)
1986	587.9 <sup>r</sup>	541.1 <sup>r</sup>	1 214.2 <sup>r</sup>	740.7	460.0	415.1
	$(6.4)^{r}$	$(4.5)^{r}$	(5.8)	(16.3)	$(8.0)^{r}$	(16.1)

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TABL	Е 2.2	(Cont.) CO PE (O	MPONENT INDEXES RCENTAGE CHANGES riginal base yea	OF BTCE ROAD CON 1978 TO 1988 r 1979-80, adjus	NSTRUCTION PRI	CE INDEXES, IN 969-70 = 100.0	()
Year							Plant acquisítion
ende	ď	Salaried	Other			Other	and
30 J	une	labour <sup>a</sup>	1abour <sup>b</sup>	Fuel <sup>c</sup>	Bitumen	materials	replacement
1987		618.2 <sup>r</sup>	566.9	1 245.0 <sup>r</sup>	674.5	495.6	464.6
		(6.8) <sup>r</sup>	(4.8) <sup>r</sup>	(2.5) <sup>r</sup>	(-8.9)	(7.7)	(11.9)
1988		657.1	589.0	1 263.3	748.7	539.2	495.1
		(6.3)	(3.9)	(1.5)	(11.0)	(8.8)	(9.6)
а.	The 1 Septe	ABS Average ember guarte orevious ser	Weekly Earnings r 1981, this seri ies based princi	series is used es was based on pally on informe	to measure 's a new survey c ation from pav	alaried labour of employers wh roll tax retur	'. From the nich replaced ns. The new
	serie	es was linke the whole p	ed to the old serveriod.	ies in order to	v provide an i	ndex on a comp	arable basis
p.	The <i>l</i> serie	ABS Average es replaced	Weekly Rates Inde the wage rates ir	ex is used to me ndexes which wer	asure 'other l te used in the	abour' from 19 BTE indexes pi	)81-82. This cior to 1981-
	82. and 5	This series Salary Earne	, in turn, was ter irs index. The n	minated in 1987- ew index was lin	-88, and has be nked to the ol	en replaced by der in order t	y an ABS Wage to provide an
0	An au	x on a compa utomotive di	irable basis for istillate index (	the whole period which is an unp	d. vublished compo	onent of ABS F	rice Indexes
	of A until	rticles Proc 1 1980-81.	duced by Manufac A series based	turing Industry on the Petrole	) was used as um Products Pi	the fuel com	ponent index ty's Maximum
	Just. baso	ified Prices	s of automotive (	distillate was u	used from 1981 d since 1984_8	-82 to 1983-8	4. A series
ч	Revie	sions to inc ted informat	dex values presention.	nted in Informat	tion Paper 23		sulting from

Note Figures in parentheses represent percentage changes.

Source BTCE estimates.







Source BTCE estimates. Figure 2.4 Comparison of rates of change of input components of fuel and bitumen

Chapter 2

date in this series. Increases in each of the previous four years had also been below 7 per cent. However, in the past increases have been much higher and rose as high as 14.5 per cent in 1981-82. The recent levelling in the rising price of labour may reflect the increasing proportion of the work-force which is being aligned with award wage increments through National Wage Case decisions.

#### Other labour

As with the salaried labour series, the 1987-88 figure reflects the lowest increase in the series (3.9 per cent). This series also mirrors the salaried labour series for earlier years, with increases of 4 to 5 per cent back to 1983-84 and a high rate of increase of 12.5 per cent in 1981-82.

#### Fuel

The rate of growth of this price component has been slowing since 1982-83. In 1987-88, the increment was only 1.5 per cent. The predominant force in this trend has been the declining world price for crude oil and the Australian Government's parity pricing policy for domestic markets. The increase in 1979-80 was a massive 61.1 per cent (see Table 2.2 and Figure 2.4).

#### Bitumen

Despite bitumen being a crude oil by-product, movements of bitumen prices in Australia often bear little relation to those of crude oil, owing to characteristics of the Australian petroleum industry.

Australian crude oil is, by world standards, a 'light' crude, that is, it yields a high proportion of lighter petroleum products (including gasoline, kerosene and so on), and a low proportion of heavier products, which includes bitumen. This means that Australia must import either heavy crude oil to produce bitumen, or bitumen itself to meet local demand. Most of the demand for bitumen is met by bitumen refined from imported crude oil.

Unlike many major petroleum products, bitumen is not subject to the parity pricing policy or any other form of price control. This allows bitumen prices to be largely determined by the combination of crude oil prices and exchange rates, and to a lesser extent by local manufacturing and marketing costs.

The 1987-88 bitumen price showed an increase of 11 per cent over 1986-87, compared to a fall of 8.9 per cent between 1985-86 and 1986-87.

#### Other materials

The other materials component of the BTCE road construction price index has exhibited the most stable rate of growth among its constituent input components. The 1987-88 figure showed an 8.8 per cent increase, compared to a 7.7 per cent increase in 1986-87.

#### Plant acquisition and replacement

This component has recently shown a declining growth rate. The 1987-88 increase was 6.6 per cent, down from 11.9 per cent in 1986-87 and the series high of 16.1 per cent in 1985-86.

#### MOVEMENTS IN THE BTCE ROAD CONSTRUCTION PRICE INDEXES

Table 2.3 shows details of the total activity index and the three sub-indexes.

#### Total activity index

The 1987-88 value for the total activity index indicates a 5.7 per cent increase over the previous year. This is a slightly larger change than that for 1986-87 despite the fact that prices of most input components for 1987-88 recorded smaller increases than in 1986-87. The two exceptions were the prices for bitumen and other material. It is mainly the large variation in the bitumen price component for 1987-88 (an 11.0 per cent increase) that has raised the total activity index by a larger amount than in 1986-87. It is important to bear in mind that it was the substantial fall in the price of bitumen in 1986-87 (a fall of 8.9 per cent) which was the major cause of the small growth in the total activity index in that year of 4.6 per cent, the smallest increase in the series.

#### TABLE 2.3 BTCE ROAD CONSTRUCTION PRICE INDEXES, 1978 TO 1988

(Base year 1979-80, adjusted so that 1969-70 = 100)

	,	Local	£ 14102-04-	
Year	State road	government		
ended	authority	authority		<i>Overall</i>
30 June	construction	construction	Maintenance	activityª
1978	260.3	258.7	263.7	260.9
	(9.6)	(9.7)	(9.8)	(9.7)
1979	280.7	279.2	285.5	281.8
	(7.8)	(7.9)	(8.3)	(8.0)
1980	325.1	324.6	330.3	326.7
	(15.8)	(16.3)	(15.7)	(15.9)
1981	376.1	375.9	380.1	377.4
	(15.7)	(15.8)	(15.1)	(15.5)

TABLE 2.3 (Cont.) BTCE ROAD CONSTRUCTION PRICE INDEXES, 1978 TO 1988

(Base year 1979-80, adjusted so that 1969-70 = 100)

	· · · · · · · · · · · · · · · · · · ·	Local		
Year	State road	government		
ended	authority	authority		Overall
30 June	construction	construction	Maintenance	activity <sup>a</sup>
1982	424.8	424.2	428.0	425.8
	(12.9)	(12.8)	(12.6)	(12.8)
1983	476.5 <sup>r</sup>	476.5 <sup>r</sup>	484.7 <sup>r</sup>	$479.4^{r}$
	(12.2) <sup>r</sup>	(12.3) <sup>r</sup>	(13.3)	(12.6)
1984	507.4 <sup>r</sup>	506.6 <sup>r</sup>	515.9 <sup>r</sup>	510.1 <sup>r</sup>
	(6.5) <sup>r</sup>	(6.3) <sup>r</sup>	(6.4) <sup>r</sup>	(6.4) <sup>r</sup>
1985	535.8 <sup>r</sup>	535.3 <sup>r</sup>	545.3 <sup>r</sup>	539.0 <sup>1</sup>
	(5.6) <sup>r</sup>	(5.7) <sup>r</sup>	(5.7)r	(5.7) <sup>r</sup>
1986	576.1 <sup>r</sup>	577.0 <sup>r</sup>	583.6 <sup>r</sup>	578.8 <sup>r</sup>
	(7.5) <sup>r</sup>	(7.8) <sup>r</sup>	(7.0) <sup>r</sup>	(7.4) <sup>r</sup>
1987	602.0 <sup>r</sup>	603.3 <sup>r</sup>	610.9 <sup>r</sup>	605.6 <sup>r</sup>
	(4.5) <sup>r</sup>	(4.6) <sup>r</sup>	(4.7) <sup>r</sup>	(4.6) <sup>r</sup>
1988	637.7	638.4	642.7	639.8
	(6.0)	(5.8)	(5.2)	(5.7)

a. These are input-price indexes and employ input components closely related to road authorities' actual expenditure items. The overall activity index and the sub-indexes were derived for the base year 1979-80 and then scale adjusted to give 1969-70 = 100.0, to facilitate comparison. Note that this adjusted scale version of the overall activity index cannot be derived simply from the three sub-indexes (SRA construction, LGA construction and maintenance). Similarly, the three sub-indexes cannot be derived simply from the component indexes in Table 2.2.
r Revisions to the index values presented in Information Paper 23 (BTE 1987) resulting from updated

Note Figures in parentheses represent percentage changes. Source BTCE estimates.

information.

#### The three sub-indexes

The State Road Authority (SRA) sub-index, the Local Government Authority (LGA) sub-index and the maintenance sub-index registered increases of 5.9 per cent, 5.8 per cent and 5.2 per cent respectively in 1987-88. This was a rise in all three cases over the 1986-87 figures of 4.5 per cent, 4.6 per cent and 4.7 per cent respectively. As with the total activity index, the 1986-87 figures were the lowest recorded.

#### COMPARISONS OF BTCE INDEXES WITH OTHER PRICE INDEXES

Table 2.4 presents a comparison of the BTCE road construction price index with other road construction indexes produced by the State authorities and with the ABS implicit price deflator for private sector gross fixed capital expenditure on non-dwelling construction (ABS 1988e). Among the State indexes, the New South Wales Department of Main Roads index showed the smallest rise of 4.1 per cent in 1987-88, down slightly from 4.5 per cent in 1986-87. The figures provided by the Main Roads Department of Western Australia showed the greatest growth of 7 per cent, also down from the previous year. The implicit price deflator (IPD) recorded an increase of 7.5 per cent for the 1987-88 period and an increase of 8.4 per cent for 1986-87.

The notable difference between the BTCE road construction price indexes (overall activity and the sub-indexes) and the other price measures detailed in Table 2.4 is that the BTCE indexes showed greater increase for 1987-88 than for 1986-87 whereas the State indexes and the IPD showed a reduced rate of growth. Such differences are mainly due to the smaller influence of the bitumen component for each state index.

Figures 2.5 and 2.6 present a comparison between the BTCE total activity index, the IPD, and the Australian CPI.





a cen van (10000, 10000). DICE CULINACED.



Per cent change

#### TABLE 2.4 COMPARISONS OF BTCE ROAD CONSTRUCTION PRICE INDEX WITH OTHER SRA INDEXES, 1977-78 TO 1987-88

(1969-70 = 100.0)

Year j ended	BTE input- price index (overall	State Roa input-p	d Authorit	State Ro	ad Authorit	y input-c	ost index	ABS implicit price deflator <sup>a</sup> private
30 June	activity)	MRD (Q10)	MRD (WA)	DMR (NSW)	RCA (VIC)	HD (SA)	DMR (Tas)	sector
1978	260.9	270.1	252.7	264.6	257.9	278.2	283.3	254.8
	(9.7)	(8.7)	(10.3)	(8.3)	(6.8)	(7.0)	(7.5)	(8.6)
1979	281.8	287.0	275.7	281.4	273.5	302.9	300.6	274.2
	(8.0)	(6.3)	(9.1)	(6.3)	(6.0)	(8.9)	(6.1)	(7.6)
1980	326.7	314.9	317.4	323.3	324.4	337.7	337.6	303.0
	(15.9)	(9.7)	(15.1)	(14.9)	(18.7)	(11.5)	(12.3)	(10.5)
1981	377.4	353.9	363.1	373.2	367.5	377.6	374.1	340.0
	(15.5)	(12.4)	(14.4)	(15.5)	(13.3)	(11.8)	(10.8)	(12.2)
1982	425.8	396.1	406.2	435.2	414.9	429.7	429.7	383.9
	(12.8)	(11.9)	(11.8)	(16.6)	(12.9)	(13.8)	(13.8)	(12.9)
1983	479.4 <sup>r</sup>	441.2	453.7	512.7	450.7	479.5	451.0	435.8
	(12.6)	(11.4)	(11.7)	(17.8)	(8.6)	(11.6)	(6.9)	(13.5)
1984	510.1	469.2	479.3	548.6	482.8	542.6	487.5	465.2 <sup>r</sup>
	(6.4) <sup>r</sup>	(6.3)	(5.6)	(7.0)	(7.1)	(13.2) <sup>r</sup>	(8.1)	(5.5) <sup>r</sup>
1985	539.0 <sup>r</sup>	494.0 <sup>r</sup>	509.5	574.7 <sup>r</sup>	507.8	571.9 <sup>r</sup>	518.6	492.1 <sup>r</sup>
	(5.7) <sup>r</sup>	(5.3)	(6.3)	(4.8) <sup>r</sup>	(5.2)	(5.4) <sup>r</sup>	(6.4)	(5.8) <sup>r</sup>

#### TABLE 2.4 (Cont.) COMPARISONS OF BTCE ROAD CONSTRUCTION PRICE INDEX WITH OTHER SRA

INDEXES, 1977-78 TO 1987-88

(1969-70 = 100.0)

Year	BTE input- price index	State Roa input-p	d Authorit rice index	y State Road	l Authorit	y input-c	ost index	ABS implicit price deflator <sup>a</sup>
anded (o 30 June `act	(overall activity)	MRD (Qld)	MRD (WA)	DMR (NSW) <sup>b</sup> F	RCA (Vic)	HD (SA) <sup>c</sup>	DMR (Tas)	sector
1986	578.8	521.0	552.1	611.1	527.8	602.8	546.1	545.8
	(7.4)	(5.5)	(8.4)	(6.3)	(3.9)	(5.4) <sup>r</sup>	(5.3)	(10.9)
1987	605.6	552.7	600.8	638.3	564.6	649.2	583.2	591.5
	(4.6)	(6.1)	(8.8)	(4.5) <sup>r</sup>	(7.0)	(7.7)	(6.8)	(8.4)
1988	639.9	585.0	642.9	664.5	594.3	693.8	618.8	635-8
	(5.7)	(5.8)	(7.0)	(4.1)	(5.3)	(6.9)	(6.1)	(7.5)

a. Gross fixed capital expenditure on non-dwelling construction

- b. The DMR (NSW) input-cost index has been extensively reviewed from 1980-81. The new index is based on a wider range of representative inputs to the road construction industry in New South Wales, such as property acquisition and financial costs which were not included in the index prior to the 1980-81 financial year. This has necessitated revisions to the DMR (NSW) input-cost index starting from 1981.
- c. The RCA (Vic), HD (SA) and DMR (Tas) input-cost indexes relate to costs at 30 June of the designated year (not average costs over the year).
- r Revisions to the index values presented in Information Paper 23 (BTE 1987) resulting from updated information.

Note Figures in parentheses represent percentage changes.

Sources ABS (1988e). Personal communication with SRAs. BTCE estimates.

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From Figure 2.6, it can be seen that the three price measures exhibit similar trends with many common turning points, except for the periods 1979-80 to 1980-81 and 1986-87 to 1987-88. The BTCE indexes were strongly influenced by large increases in the prices of fuel and bitumen in 1979-80 and 1980-81 (see Table 2.2), and by movements of bitumen prices in 1986-87 and 1987-88, as previously mentioned.

#### APPENDIX I REVIEW OF EXISTING ROAD CONSTRUCTION INDEXES

TYPES OF INDEXES

A wide range of cost and price indexes for road construction activity has been produced and has led to widespread debate as to their respective merits. Major index types relate to 'price' changes or 'cost' changes, and include:

- . input-price indexes
- . input-cost indexes
- . output-cost indexes
- expenditure deflator indexes.

In addition, the State road authorities (SRAs) have each developed their own road construction price indexes, and the former Commonwealth Bureau of Roads (CBR) had also developed indexes of national road construction activity. A brief review of these indexes is presented below.

#### Input-price indexes

This index type is constructed from the disaggregated input-price components of road construction, such as fuel, labour and materials. The price movements for each component are approximated through indexes derived from other sources such as the Australian Bureau of Statistics (ABS). These components may be combined through various

weighting schemes in order to suit a particular type of construction activity or a particular geographic region. Generally, such a weighting scheme would have a fixed base year. However, variable weights are possible but require regular reassessment of component shares.

#### Input-cost indexes

Input-cost indexes are defined as the costs of representative units of inputs to the road construction industry, as indicated by actual costs incurred by road authorities. Similar to input-price indexes, input-cost indexes are divided into various input components and generally have a fixed base weighting scheme.

#### Output-cost indexes

These indexes measure the cost of outputs of road construction activity, that is, actual roads constructed. Usually, such an index would measure the cost of producing a fixed 'unit' of road output, for instance, a kilometre of road of a certain standard.

#### Expenditure deflator indexes

Expenditure deflators which have been used in Australia as proxies for road construction price indexes are the implicit price deflators (IPDs) which can be derived from the Australian national accounts (1988f). Two of the IPDs produced by the ABS have been used as guides to price movements in road construction, these are:

- . private fixed capital expenditure on non-dwelling construction; and
- . public fixed capital expenditure on non-dwelling construction.

#### COMPARISON OF THE INDEX TYPES

For an organisation requiring a road construction index, the choice of an index type will largely depend upon the needs of that organisation, the anticipated function of the index, and the type of resources available to obtain the necessary data. Each index outlined above has advantages and disadvantages, most relating to ease of obtaining data, and the interpretation of results.

#### Data collection

One of the easiest indexes to maintain in terms of obtaining data is the input-price index. As the input components are derived from external, nationally available sources, it is an easy task for the construction authority, or any other organisation armed with source information, to update the indexes.

Input-cost indexes, on the other hand, require considerably more effort, although a normal internal accounting system should provide the raw data required.

Output-cost indexes require not only cost data from construction authorities, but also need information concerning the type, quantity and quality of the road construction and maintenance projects which have been completed. This enables the cost data to be related to a standard unit of output for a particular time period.

Of the index types discussed here, the easiest to obtain are the implicit price deflators. Figures for the public sector and private sector fixed capital expenditure on nondwelling construction are readily available in index form from the ABS.

#### Interpretation of results

The use of external data sources for the input components of an input-price index means that the choice of those sources is important to obtaining an index which reflects, as nearly as possible, movements in the actual prices of road construction inputs. Interpretation of input-price indexes must be made in the light of this use of proxy prices. Additionally, it must be remembered that no measure is included of any quality and productivity changes which may have occurred in the road construction industry over the span of the index.

This deficiency is shared by the input-cost index. However, the input-cost index is superior to the inputprice index, in terms of reliability, in that it accurately tracks actual input component costs, and also readily allows the use of the more precise, variable weight scheme.

Output-cost indexes provide a measure of the total cost of producing a unit of output which reflects changes in productivity and quality of road construction. However, output-cost indexes do not specifically quantify those changes. Consequently, some output-cost indexes are accompanied by related productivity indexes, while others are themselves a product of input-cost indexes combined with a productivity index.

Implicit price deflators are the least reliable source of road construction price movements, not having been designed for this purpose. Road construction activity is included in the ABS data for the public and private fixed capital expenditures on non-dwelling construction, but the share cannot accurately be identified.

The interpretation of each of the index types is affected by changes within the road construction industry. Over the

last few decades, there have been considerable changes in road design standards and engineering practices, safety and environmental considerations. These factors are difficult to quantify in terms of their impact on road construction activity. Additionally, over this same period, there have been changes in the level of, and emphasis of, road funding from government sources, altering the economies of scale of both total road construction activity, and of the different types of activity.

#### STATE ROAD AUTHORITY INDEXES

Road construction price indexes are produced by the State road authorities in each Australian State and the Northern Territory. The indexes produced are mostly input-price or input-cost indexes, but different methodologies and levels of disaggregation have been employed in their calculation.

#### New South Wales

The NSW Department of Main Roads has produced an input-cost index since 1939. The input components are drawn from a detailed cost breakdown and are aggregated into a maintenance index, a road construction index, and a bridge construction index. These three indexes are produced both for the Sydney region and for the rest of the State. Using these individual indexes, an overall 'Cost Rise Index' for New South Wales is derived, and is shown in Table 2.4.

#### Victoria

The Victorian Road Construction Authority (formerly the Country Roads Board of Victoria) produces both an inputcost index and an output-cost index. The input-cost index is derived not from the costs incurred throughout a period, but from the prices current at the end of that period.

Unit input-costs for labour, materials, plant and sundries are aggregated to form indexes of;

- . field patrol and other maintenance;
- . bitumen surfacing; and

. road and bridge construction.

These indexes are combined with an administrative salaries component to give the 'direct works and salaries index' included in Table 2.4.

The output-cost index is designed to measure the construction cost of one kilometre of rural road. This index has not been included in Table 2.4, as it cannot directly be compared with input-price or input-cost indexes. The reason why these indexes cannot directly be compared is due to the movements caused by the combination of changes in technology, engineering practices, productivity and so on, which cannot be separately quantified.

#### Queensland

A 'roadworks input-cost index' is produced by the Main Roads Department (MRD) of Queensland. Despite the title, this index is an input-price index, in terms of the definitions used in this Paper, and has been presented as such in the comparison shown in Table 2.4. The index uses ABS figures to represent movements in the price of labour, materials, plant purchase and plant maintenance. The roadworks index is a weighted combination of these four individual indexes.

#### South Australia

The South Australian Highways Department produces an overall 'Roadworks Input-Cost Index' which has been published since 1970. This index is a weighted average of several other aggregate indexes including road construction, maintenance and bridge construction.

#### Western Australia

The Western Australian Main Roads Department has prepared an overall input-price index based on the Queensland MRD index, using external ABS sources to measure price movement.

#### Tasmania

The Department of Main Roads in Tasmania produces an input-cost index, which is a weighted average of three sub-indexes of road construction, maintenance, and bridge construction. These three aggregate indexes are derived from cost movements for input components of labour, materials, plant, property acquisition, and sundries.

#### NATIONAL ROAD CONSTRUCTION ACTIVITY INDEXES

The national road construction activity indexes, related to construction and maintenance expenditure for activity associated with the total Australian road system, were developed by the former Commonwealth Bureau of Roads (CBR) in conjunction with its road assessment studies. The CBR indexes used the national accounting concepts. Data from input-output tables for the Australian economy were used to break down the industry expenditures into the primary national accounting components such as: wages, salaries and supplements; depreciation and enterprise income tax;

commodity payroll taxes and import and export duties. Further modification to the basic input-output data will be required for the breakdown of the building and construction sector into 'road construction' and other 'building and construction'. Details of these index types are described in the following publications:

- CBR (1969) Cost indexes applicable to road construction;
- . CBR (1975) Report on roads in Australia;
- . Burke, R (1978) A road construction price index.

#### APPENDIX II CURRENT SOURCES FOR INPUT-PRICE COMPONENT INDEXES

#### Salaried labour

#### ABS 6302.0,

Average weekly earnings, States and Australia. Average weekly total earnings, all males financial year average of quarterly figures.

#### Other labour

#### ABS 6312.0,

Award Rates of Pay Indexes, Australia, Table 1. Award rates of pay indexes full-time adult employees: Australia Weekly series, males.

#### Fuel

ABS 6401.0, Consumer Price Indexes, Australia, Transport group, automotive fuel index, financial year average of quarterly figures.

#### Bitumen

Shell Company of Australia Limited. Price of roadmaking grade bitumen, December price for Melbourne.

Other material

ABS 6407.0,

Price index of materials used in building other than house building.

All groups, weighted average of six State capital cities, financial year figure.

Plant acquisition and replacement

ABS 6412.0

Wholesale prices section:

Construction & earthmoving machinery (ASIC class 3332), financial year figures.

Unpublished component of 'Articles produced by manufacturing industry'.

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#### ABBREVIATIONS

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ABS	Australian Bureau of Statistics
AGPS	Australian Government Publishing Service
BTCE	Bureau of Transport and Communication Economics
BTE	Bureau of Transport Economics
CBR	Commonwealth Bureau of Roads
CPI	Consumer price index
DPIE	Department of Primary Industry and Energy
IPD	Implicit price deflator
PPPA	Petroleum Products Pricing Authority
LGA	Local government area
SRA	State road authority