REPORT OF THE ROYAL COMMISSION ON

CROSS-RIVER TRAFFIC IN LONDON



Report of the Royal Commission on Cross-River Traffic in London

Dated 30th November, 1926

Presented to Parliament by Command of His Majesty

LUNDON:

PRINTED & PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

To be purchased directly from H.M. STATIONERY OFFICE at the following addresses:
Adastral House, Kingsway, London, W.C.2; 120. George Street, Edioburgh;
York Street, Manchester; 1, St. Andrew's Crescent, Cardiff;
15. Donegall Square West, Belfast;
or through any Bookseller.

1926

Price 4s. Net

NOTE.

The estimated cost of the preparation of this Report and Minutes of Evidence (including the expenses of the Commission) is £2,994, of which £388 represents the estimated cost of printing and publishing of this Report.

The Minutes of Evidence are published in a separate volume.

THE ROYAL COMMISSION.

GEORGE R.I.

GEORGE THE FIFTH, by the Grace of God, of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas King, Defender of the Faith, to

Our Right Trusty and Well-beloved Cousin and Counsellor Arthur Hamilton, Viscount Lee of Fareham, Knight Grand Commander of Our Most Exalted Order of the Star of India, Knight Grand Cross of Our Most Excellent Order of the British Empire, Knight Commander of Our Most Honourable Order of the Bath;

Our Right Trusty and Well-beloved Cousin William Frederick Danvers, Viscount Hambleden;

Our Right Trusty and Well-beloved Counsellor Sir Willoughby Hyett Dickinson, Knight Commander of Our Most Excellent Order of the British Empire;

Our Trusty and Well-beloved :--

Sir William Plender, Baronet, Knight Grand Cross of Our Most, Excellent Order of the British Empire;

Sir Lawrence Weaver, Knight Commander of Our Most Excellent Order of the British Empire, and

Charles Edward Inglis, Esquire, Officer of Our Most Excellent Order of the British Empire, Member of the Institution of Civil Engineers, Professor of Mechanism and Applied Mechanics, Cambridge University:

Greeting!

Whereas We have deemed it expedient that a Commission should forthwith issue to survey the whole problem of cross-river traffic in London; to report what provision should be made to meet future requirements, and, in particular, to consider the proposals made in connexion with Waterloo and St. Paul's Bridges:

Now know ye that We, reposing great trust and confidence in your knowledge and ability, have authorised and appointed, and to by these Presents authorise and appoint you the said Arthur Iamilton, Viscount Lee of Fareham (Chairman); William rederick Danvers, Viscount Hambleden; Sir Willoughby Hyett Dickinson; Sir William Plender; Sir Lawrence Weaver and Charles Edward Inglis to be Our Commissioners for the purposes of the said Inquiry:

And for the better effecting the purposes of this Our Commission, We do by these Presents give and grant unto you, or any four or more of you, full power to call before you such persons as you shall judge likely to afford you any information upon the subject of this Our Commission; to call for information in writing; and also to call for, have access to and examine all such books, documents, registers and records as may afford you the fullest information on the subject, and to inquire of and concerning the premises by all other lawful ways and means whatsoever:

And We do by these Presents authorise and empower you, or any one or more of you, to visit and personally inspect such places as you may deem it expedient so to inspect for the more effectual carrying out of the purposes aforesaid:

And We do by these Presents will and ordain that this Our Commission shall continue in full force and virtue, and that you, Our said Commissioners, or any four or more of you, may from time to time proceed in the execution thereof, and of every matter and thing therein contained, although the same be not continued from time to time by adjournment:

And We do further ordain that you, or any four or more of you, have liberty to report your proceedings under this Our Commission from time to time if you shall judge it expedient so to do:

And Our further will and pleasure is that you do, having regard to the urgency of the question, report to Us at the earliest possible date under your hands and seals, or under the hands or seals of any four or more of you, your opinion upon the matters herein submitted for your consideration:

And for the purpose of aiding you in your inquiry We hereby appoint Edward Goldie Howarth, Esquire, of the Board of Education, to be Secretary to this Our Commission.

Given at Our Court at Saint James's, the Twenty-fourth day of July, 1926; in the Seventeenth Year of Our Reign.

By His Majesty's Command.

W. Joynson-Hicks.

TABLE OF CONTENTS.

											Page.
Introduct	ion	•••	•••	•••	•••	•••	•••	***	•••	•••	1
CHAPTER :	I—Pı	eviou	s histor	y of tl	ne prob	lem	•••	•••	***	•••	3
CHAPTER 1	IIG	enera	l guest	ions af	fecting	CFOSS-I	iver	traffic	•••	•••	Ð
			ea deal				•••		•••	•••	9
		Gr	owth of	Lond	on and	its tra	ffic	•••	***	•••	ก
		$\mathbf{D_{i}}$	stributi	on of	eross-ri	ver tra	ıffiq		•••	•••	13
ė		Ar	terial F	loads	,	•••	•••		•••		15
-		Na	vigatio	n inte	rests		•••	***	•••	***	17
CHAPTER]	III—	Water	rloo Bri	idge			•••	•••	•••	•••	22
CHAPTER]	[V	St. Pa	ul's Br	idge	444						31
•			oposed		gate" F		***	•••	•••	***	37
CHAPTER V	v—o	ther t	ridges	in the	central	area		•••		•••	42
			oposed				ross				42
			wer Bri		•••		•••	•••		•••	47
		Lo	ndon B	ridge	***		•••	•••	***	•••	48
		Bla	ckiriar	s Brid	ge			•••	•••	•••	49
		We	stmins	te r Bri	dge	•••	•••		•••	•••	49
		La	mbeth 1	3ridge	•••			***	***	•••	5 0
		\mathbf{Va}	uxhall [Bridge	•••	•••	•••	•••	•••	•••	51
CHAPTER VI-Up-river bridges and Western Exits										52	
,	Chelsea (or Victoria) Bridge								52		
			ert Bri		***			•••			52
			ttersea	_	·		•••	•••	•••	•••	52
			ndswor	-				•••		•••	53
			tney Br			•••		•••	•••		53
			mmersn	_	ridge		•••	•••	•••	•••	54
		Ke	w Bridg	ge		•••	,	•••	***	•••	54
		Ric	hmond	Bridge	2			•••	•••	•••	54
		Kir	ngston]	Bridge			•••			•••	55
		Ha	mpton (Court :	Bridge	•••	•••	***	•••	•••	55
		Wa	lton Br	idge	•••		•••	•••	•••	•••	56
		Che	rtsey E	ridge	•••	• • •	•••	***	•••		56
		Sta	ines Br	idge	•••	•••	•••	•••	***	•••	56
		Nev	v Chert	sey Ro	ad sche	me	•••	•••		•••	56
		We	stern E	xits	••	•••		***	·	•••	56
60454										A 3	;

				•			-	. 4	Page
Снарт	er VIICross-ri	ver commu	nicatio	ons belo	w Tow	er Bri	idge	•••	59
~		erhithe Tun		•••	***	•••	•••	•••	59
	Green	wich Tunn	el	•••	•••	•••	•••	•••	60
	Black	wall Tunne	1	•••	•••	•••	•••	•••	60
	Wool	wich Tunne	l	***	•••	•••	•••	•••	60
		wich Free F	_			•••	•••	•••	60
	Prop	osed High-le	evel B	ridge at	t Wool	wich			61,
		esend—Tilb	_		•••	•••	•••	•••	61
		osed Graves						•••	61
		osed Dartfo			Tunne	l	***	•••	62
	Viete	oria Dock R	oad sel	neme	•••	•••		***	62
Снар	ren VIII-A Cen	tral Bridge	s Auth	ority	•••	•••	•••	•••	64
Снар	ren IX.—Finance	•	•••	•••		•••	***	•••	70
Снар	ren X—Miscellan	eous	•••	•••	•••	•••	•••	•••	75
	Cove	nt Garden I	Market	t		•••	•••	•••	75
	Stree	et Trading	•••	•••	***	•••	•••	•••	75
	The	siting of pu	blic co	nvenier	1Ces	•••	•••	•••	76
	_	posts	•••	***	•••	•••		•••	76
	Deve	lopment of	the so	uth side	of the	e river	• • • • • • • • • • • • • • • • • • • •	•••	76
	Prop	osed extens	ion of	Chelses	a Emba	nkme	nt	•••	77
Снаг	TER XI—Summa	ry of Recon	nmend	ations	•••	•••		•••	78
	Conc	lusion	•••	•••	•••	•••	•••	•••	83
		AP	PENI	ICES.					
1.	Petition to the P	rime Minist	ter	•••		•••	•••		85
2.	Preliminary Ques	stionnaires	•••						88
3.	Extract from the	evidence of	Sir A	lexand	er Gibb	, G.B.	E., C.B		92
4.	Waterloo Bridge	•••	•••	•••			***	•••	95
	(i) Longitud			_		•••			95
	(ii) Photogra	•		_		***	•••	•••	95
5.	Diagrams showin				_			_	95
6.	Diagrams showin of Waterloo		channe 	els avai	lable d	uring 	restora		106
7.	Maps illustrating						•••		108
8.	Description of th								109
9.	Maps and plan scheme							idge	112
10.	Typical diagrams	s of double-d	leck br	idges	•••	***	•••		114
11.	Constitution of Committee					Traffi	c Adv	_	710
12.		tornotiro -	,,, nonce-	 la fa-	*** **** 337	•••	···	···	116
44.	Map showing al London	··· ···	roposa		цеw W	estern 	EXIT		118
13.	Letters from the	Southern I		у Сотр	any	•••		•••	119
Indi	8 x				-				123

INDEX.

(Numbers refer to paragraphs).

Albert Bridge:

Description and dimensions, 142.

History, 7, 19.

Reconstruction and widening, recommendation and estimated cost, 142, 194, 208 (ix).

Traffic and capacity, 37, 142.

Arterial Road construction schemes, 45-8.

Battersea Bridge:

Approaches, 143.

Description and dimensions, 143.

History, 7, 19.

Navigation difficulty, 143.

Traffic and capacity, 37, 143.

Widening desirable but not urgent, 143.

Blackfriars Bridge:

Description and dimensions, 135.

"Ludgate" Bridge would relieve, 135.

Relief:

Necessary, 37.

by Southwark Bridge not possible to any serious extent, 100. Traffic and capacity, 37, 135.

Blackfriars Railway Bridge and viaduct from, construction of road along, scheme, see "Ludgate" Bridge.

Blackwall Tunnel:

Congestion, 165.

History, 7.

Roadway, improvement recommended, 165, 208 (xvii).

Traffic. 37.

Ventilation, improvement recommended for removal of restriction on certain classes of traffic, 165, 209 (xvii).

Blomfield, Sir Reginald, R.A., proposals for widening Waterloo Bridge, App. 5 (pp. 95-8).

Bridges:

Central Authority, see under Cross-River Communications.

Construction, chronological list, 7, 11.

Diversity of authorities over, 183-4.

Double deck, diagrams, App. 10 (pp. 114-5).

High level, importance of, 40, 42.

Maintenance, history of system, 9-10, 193 (a).

New:

Port of London Authority's jurisdiction in connection with, 52. Recommendations, summary, and estimated cost, 194, 208.

. Revenue for dealing with, present sources, 193.

Traffic capacity:

Arterial roads in connection with, 43-8.

Connection with approaches, 37.

v. Tunnels and ferries, 159-162.

Types most desirable from point of view of navigation, 58. Weight limits, 140.

Cannon Street Railway Bridge, acquisition of interests in, by Metropolitan Board of Works, 19.

Central Traffic Authority, see under Traffic.

Charing Cross new Bridge: 121-32.

estimated Cost, 194.

Essential, 122.

Evidence re, summary of, 121-2.

High level bridge down river from existing bridge, advantages and disadvantages, 124.

High level double deck, bridge:
Scheme for steel bridge immediately alongside present railway bridge, 127-32, 208 (iv), App. 8 (pp. 109-11).

Maps and plan illustrating, App. 9.

Royal Fine Art Commission should consider design, 132.

Southern Railway Company's attitude re, 129, App. 13 (pp. 119, 120-1).

Captain Swinton's scheme, advantages and disadvantages, 125, 126. Influence on development of south side of river, 206.

Provision of St. Paul's Bridge and, and widening of Waterloo Bridge, traffic requirements of central area would be met for 30 years, 84. Recommended by Select Committee in 1854, 15, 121.

Requirements, 127.

Schemes put forward re, 123-126.

Use of present railway bridge and removal of station to south side of river, undesirable, 123.

Westminster Bridge would be relieved by, 137.

Charing Cross Bridge (present), history, 7, 19.

Chelsea (Victoria) Bridge:

Description and dimensions, 141.

History, 7, 19.

Reconstruction and widening, recommendation and estimated cost, 141, 194, 208 (viii).

Traffic and capacity, 37, 141.

Cheisea Embankment, proposed extension, 207.

Chartsey Bridge:

Description and dimensions, 152.

Traffic capacity, 152.

Chertsey Road:

estimated Cost, 194.

Extension of Cromwell Road to, schemes and recommendation, 155-8, 208 (xv).

Map. App. 12.

Richmond Bridge will be relieved by, 148.

Scheme and recommendation re, 154, 208 (xiv).

Chiswick, new bridge, need for, and recommendation, 154, 157, 158, 194, 208 (xiv, xv).

Conference of Societies, report re Waterloo Bridge, 67.

Covent Garden Market: 202.

Site, no recommendation, 202.

Crawford, Lord, evidence quoted, 88.

Cromwell Road extension scheme, recommendation and cost, 156-8, 194, 208 (xv), App. 12.

Cross-River Communications:

see also Bridges, Ferries and Tunnels.

Central Authority:

Financing of, recommendation, 192-200, 208 (xxiii).

Functions, 186, 189-91, 208 (xxii).

Need for, 183-7.

Traffic Advisory Committee as, scheme, 188-91, 208 (xxii).

History of, 7-24.

Proposals, 208.

estimated Cost, 194.

Requirements, distribution of population in connection with, 28.

Cross Traffic, see under Traffic.

Dartford-Purfleet tunnel:

Advantages to be derived, 171.

estimated Cost, 194.

Scheme and adoption recommended, 171, 208 (xx).

Docks, congestion and need for improvement of traffic facilities, 172, 173.

Dorset Wharf, proposed new bridge at, and recommendation, 157, 158, 208 (xv), App. 12.

Elephant and Castle, circular by-pass scheme, 48.

Ferries, v. bridges and tunnels, 159-62.

Fitzmaurice, Sir Maurice, report on proposed Gravesend-Tilbury tunnel referred to 170.

Gedye, Nicholas, M.Inst.C.E., proposal for widening Waterloo Bridge, App. 5 (pp. 102-3).

Gibb, Sir Alexander, G.B.E., C.B., evidence of, 77, 78, 79, App. 3 (pp. 92-4).

Gravesend-Tilbury Ferry: 169.

Acquisition by the public and placing on same basis as Woolwich free ferry recommended, 169, 208 (xix).

Gravesend-Tilbury tunnel, scheme examined but considered less advantageous than Dartford-Purfleet tunnel, 170.

Greater London:

Area, 13, 26.

Population:

1901, 1911, 1921, 27.

Distribution between north and south of the Thames, 28.

Occupied persons resident, 1921, 29.

Greenwich Tunnel: 164.

History, 7.

Hammersmith Bridge:

Description and dimensions, 146.

History, 7, 19.

Rebuilding and widening, recommendation and estimated cost, 146, 158, 194, 208 (xii).

Repairs, constant, 146.

Traffic and capacity, 37, 146.

E

Hampton Court Bridge:

Description and dimensions, 150.

New bridge:

Recommendation and estimated cost, 150, 194, 208 (xiii).

Schemes examined, 150.

Traffic and capacity, 150.

Holborn Viaduct, high level road beside railway to Southwark Street, scheme, see "Ludgate" Bridge.

Holborn Viaduct Station, reconstruction necessitated by "Ludgate" Bridge scheme, attitude of Southern Railway, 118, App. 13 (pp. 121, 122).

Horse vehicle traffic:

1913, 1926, 33.

Cross-river, 8 a.m. to 8 p.m. 1926, 34.

Humphreys, G. W., C.B.E., M.Inst.C.E., Chief Engineer of the L.C.C.. Evidence referred to, 80.

Waterloo Bridge, diagrams showing waterways which would be available during rebuilding, App. 6 (pp. 106-7).

Hungerford Bridge, see Charing Cross.

Kew Bridge:

Approaches, public convenience in centre of road, delay caused by, and removal recommended, 147, 204.

Description and dimensions, 147.

Traffic capacity, 147.

Kingston Bridge:

Approaches, southern, improvement recommended, 149.

Description and dimensions, 149.

new Kingston by-pass road will relieve, 149.

Traffic capacity, 149.

Lambeth Bridge:

Approaches, improved provision recommended, 138, 208 (vi).

History, 7, 19.

Reconstruction:

estimated Cost (including improvement of approaches), 194.

Design objected to, from point of view of navigation, 138, 208 (vi). Scheme, 82, 138.

Relief of Vauxhall Bridge by, possible, 37.

Usefulness somewhat limited, 138.

London, planning and improvements, enquiries re, 13, 15.

London Bridge:

Approaches, 134.

Description and dimensions, 134.

History, 7, 9, 19.

Relief of:

"Ludgate" bridge would relieve, 134.

Necessary, 37.

by Southwark Bridge not possible to any serious extent, 100. Traffic and traffic capacity, 37, 134.

London, City of:

Bridge House Estate funds, 193 (a), 195, 208 (xxiii).

Corporation:

Proposals re St. Paul's Bridge, 94-8.

London, City of-Cont.

Corporation—Cont.

Questionnaire for, App. 2 (p. 91).

New north and south route, urgently required between Aldersgate Street and Southwark Street, 109.

London County Council:

Acquisition of interest in bridges, 20.

Attitude re Charing Cross Bridge, 122.

Position as "improvement authority" and "bridge authority" for County of London, 193 (c).

Position re St. Paul's Bridge, 98. Position re Waterloo Bridge, 22, 65, 66, 69.

Powers to construct or reconstruct bridges, 20.

Questionnaire for, App. 2 (p. 91).

Resolution re dealing with cross traffic, 41.

London and Home Counties Traffic Advisory Committee, see under Transport, Ministry of.

London, Port of:

Authority:

Jurisdiction in connection with new bridges, 52.

Victoria Dock Road scheme, 172, 174.

Improvement, 51.

" Ludgate" Bridge:

Blackfriars Bridge would be relieved by, 135.

estimated Cost, 194.

London Bridge would be relieved by, 134.

Scheme, 113-20, 208 (iii).

Maps illustrating scheme, App. 7.

Southern Railway Company's attitude re, 113, 118; App. 13 (pp. 119, 121, 121-2).

Ludgate Hill Station, demolition of, attitude of Southern Railway Company, 118, App. 13 (p. 121).

Maybury, Sir Henry P., K.C.M.G., C.B., M.Inst.C.E., attitude re proposed "Ludgate" Bridge and St. Paul's Bridge, 119.

Metropolitan Board of Works:

Acquisition of bridges by, 19.

Creation, 1855, 17.

Street, etc., improvements by, 1855 to 1889, 17.

Motor traffic:

Comparison with U.S.A., 36.

Cross river, 8 a.m. to 8 p.m., 1926, 34.

Increase:

since 1914, 35.

Anticipated, 32, 36.

in Excess of increase in number licensed, 36.

Statistics, 1922, 1923, 1924, 1925, County of London, Home Counties and total, 35.

Muirhead, W., M.Inst.C.E., proposal for widening Waterloo Bridge, App. 5 (pp. 104-5).

Navigation, see under River Traffic.

Omnibuses, passenger traffic statistics, 1911, 1921, 1925, 30, 31.

Palmer, Frederick, report on Westminster Bridge, 136.

Population of County of London and Greater London, 27, 28, 29.

Purfleet-Dartford tunnel, see Dartford.

Public conveniences, obstruction caused by, and recommendation re, 204.

Putney Bridge:

Approaches, improvement essential, 145, 208 (xi).

Description and dimensions, 145.

History, 7, 19.

Traffic, 37.

Widening and improvement, recommendation and estimated cost, 145, 194, 208 (ix).

Railways, passenger traffic statistics, 1911, 1921, 1925, 30, 31.

Richmond Bridge:

Approaches, 148.

new Chertsey road and bridge will relieve, 148.

Description and dimensions, 148.

Reconstruction not recommended, 148.

Traffic capacity, 148.

Richmond, new Bridge, need for, 154, 208 (xiv).

River traffic:

Barges:

Statistics, 54.

System, 54, 56, 59.

Categories of, 54. Importance of, 49, 50.

above London Bridge, increase, and further increase anticipated, 53.

Motor barges, unsuitability of, 54.

Navigation:

Effect of bridges on, 57-60.

Non-interference with, importance of, 60.

Questionnaire, App. 2 (p. 90).

Types of bridges desirable from point of view of, 58.

Sea-going steamships, 55, 56.

Road Fund:

Allocation of annual sum from, for proposed cross-river communication schemes, recommendation, 192, 196-200, 208 (xxiii).

Grants, system, 193 (b).

Revenue, 193 (b).

Road Transport, advantages of, 32.

Roads, maintenance system, 193.

Rotherhithe Tunnel:

Approaches and roadway, improvement recommended, 163, 208 (xvi).

History, 7.

Traffic, 37.

Ventilation, improvement recommended, 163, 208 (xvi).

" Roundabout " system, 39,

Royal Commission on Cross-River Traffic in London, appointment and terms of reference, p. iii-iv, 23, 24, 68.

Royal Commission of inquiry into communication in the Metropolis, 1842, 14.

Royal Commission on London Traffic, 1903-5, 21, 33, 177.

Royal Fine Art Commission, 67, 91, 107, 132, 150.

St. George's Circus, circular by-pass scheme, 48.

St. Paul's Bridge: 92-111.

not Advocated and alternative scheme ("Ludgate" Bridge) proposed, 111-20, 208 (ii).

Arguments put forward for, in connection with new north and south arterial route, 101.

Danger to St. Paul's Cathedral:

Benefit of doubt should be given to Cathedral, 110.

Objections of Cathedral authorities, 102.

Report by Royal Fine Art Commission, 107.

Drapery trade objections, 106.

Effect on Cathedral services and Churchyard amenities, evidence of Dean and Chapter, 103, 104.

possible Effect on traffic in Cannon Street and Cheapside, 101, 109. Finance of, 96.

"High-level" principle not fully carried out by proposal, 109.

Line proposed by City Corporation, 94. London County Council position in regard to, 98.

Map, App. 7.

Objections, summary of, 102-6.

Opposition to, by river navigation interests, and agreement with, 105.

Proposal, history of, 93-8.

Provision of Charing Cross Bridge and, and widening of Waterloo Bridge, traffic requirements of central area would be met for 30 years, 84.

Questionnaire, App. 2 (p. 89).

Recommended by Select Committee in 1854, 15, 93, 121.

St. Paul's Station, abolition as terminal station, attitude of Southern Railway, 113, 118, App. 13 (pp. 121, 122).

Select Committee on Metropolitan Bridges, 1854, 15, 16, 93, 121.

Signposts, recommendation re, 205.

Southern Railway Company:

Attitude re proposed Charing Cross Bridge scheme, 129.

Attitude re proposed "Ludgate" Bridge, 113, 118.

Letters from, τ_e Charing Cross and Blackfriars Bridge schemes, App. 13 (pp. 119-22).

Southwark Bridge: 43.

Approaches, bad conditions, 100.

History, 7, 13.

Reconstruction, 100.

Relief of Blackfriars and London Bridges by, not possible to any extent, 100.

Traffic, 37.

Traffic capacity, non-use to full extent, 100.

Southwark Street, high level road beside railway line to Holborn Viaduct, scheme, see "Ludgate" Bridge.

Staines Bridge:

Approaches, improvement, double amount of traffic could be taken, 153. Description and dimensions and traffic capacity, 153.

Strand, Wellington Street crossing, improvements necessary if Waterloo Bridge widened, 83.

Street trading:

Congestion caused by, 203.

Diversion from main approaches of bridges desirable, 203.

Surrey County Council, scheme for new Hampton Court Bridge, 150.

Swinton, Captain George, Charing Cross Bridge scheme, 125, 126.

Thames Embankment, possible extension on South side of river, 206.

Tilbury, see Gravesend-Tilbury.

Tolls, abolition:

by Metropolitan Toll Bridges Act, 1877, 13, 19. Recommendation of Select Committee of 1855, 16.

Tower Bridge:

Approaches:

Condition, 133, 202,

Hay market, removal recommended, 133, 208 (v).

South, recommendation, 208 (v).

Description and dimensions, 133.

History, 7.

Traffic and traffic capacity, 37, 133.

Traffic:

Central Authority:

Previous recommendations re, 22, 175-81.

Traffic Advisory Committee as, scheme, 188-200, 208 (xxii, xxiii).

Cross:

Difficulty caused by, 39.

Different levels for, L.C.C. resolution, 41.

Methods of dealing with, 39-41.

Cross-River:

1921, 29.

1926, on various bridges, etc., 37.

between 8 a.m. and 8 p.m., 1926, 34,

Increase, 1914-24, 34.

Greater London, passenger statistics, railway, tramways and omnibus, 1911, 1921, 1925, 30, 31.

Long distance through traffic, diversion from congested areas, recommendation re signposting, 205.

Problem, history of, 8-23.

Questionnaire, App. 2 (pp. 89-90).

Regulation, importance of, 38.

Road transport, advantages of, 32.

Travelling habit, growth of, 31.

Tramways, passenger traffic statistics, 1911, 1921, 1925, 30, 31.

Transport, Ministry of:

Creation, 180.

Cromwell Road extension scheme of, 156, 158, App. 12.

Transport, Ministry of-Cont.

Director-General of the Roads Department, attitude re proposed "Ludgate" Bridge and St. Paul's Bridge, 119.

London and Home Counties Traffic Advisory Committee: 182.

Attitude re Charing Cross Bridge, 122

as Central Traffic Authority, scheme, 188-200, 208 (xxii, xxiii). Constitution, App. 11 (pp. 116-7).

Report on Victoria Dock Road scheme referred to, 173.

and St. Paul's Bridge scheme, 101. Victoria Dock Road scheme, 172-4.

Tunnels:

v. Bridges and ferries, 159-62. Ventilation question, 161.

Vauxhall Bridge:

Description and dimensions, 139.

History, 7, 19.

Relief of, possible by completion of new Lambeth Bridge, 37.

Traffic and capacity, 37, 139.

Vauxhall Cross:

Improvements at:

Cost would be small, 194.

Recommendation re, 139, 208 (vii).

Reconstruction and widening of Chelsea Bridge would relieve congestion at, 141.

Victoria Bridge, see Chelsea Bridge.

Victoria Dock Road scheme:

estimated Cost, 194.

Particulars re, and approval of, 172-4, 208 (xxi).

Walton Bridge:

Description and dimensions, 151.

no Recommendation re, 151.

Traffic capacity, 151.

Wandsworth Bridge:

Description and dimensions, 144.

History, 7, 19.

Reconstruction as 4 line bridge and improvement of approaches, recommendation and estimated cost, 144, 194, 208 (x).

Traffic and capacity, 37, 144.

Waterloo Bridge:

Arch, diagram, App. 10 (p. 114).

Cementation operations, 64.

Description, 63.

Demolition, not recommended, 78.

Evidence of Sir Alexander Gibb, G.B.E., C.B., App. 3 (pp. 92-94).

Foundations, divergent views put forward re method of dealing with, 72.

Granite, quality, 79.

History, 7, 11, 13, 19, 62.

Longitudinal elevation as designed by John Rennie, App. 4 (facing p. 95).

Navigation difficulty, 85.

Petition to the Prime Minister re, June 1928, 23, 68, App. 1 (pp. 85-7). Photograph, App. 4 (facing p. 95).

```
Waterloo Bridge—Cont.
```

Piers:

Nos. 1, 2, 7, 8:

Restoration possible, Gibb, App. 3 (p. 94).
Underpinning by "free air", open cofferdam, method, recommendation, 78, 208 (i); Gibb, App. 3 (p. 94).

Nos. 3, 4, 5, 6 and arches, rebuilding recommended, 78, 208 (4); Gibb, App. 3 (p. 94).

Depth of foundations, 78, 208 (i); Gibb, App. 3 (p. 94).

Preservation, urged by Conference of Societies and Royal Fine Art Commission, 67.

Problem, 22-23, 70-75.

Position of London County Council, and acknowledge of attitude, 69. Questionnaire, App. 2 (pp. 88-9).

Reconstruction:

see also Widening below.

not Essential, 78; Gibb, App. 3 (p. 93).

Diagrams showing waterways which would be available during; Humphreys, App. 6 (pp. 106-7).

London County Council decisions, 65, 66

Report of Conference of Societies against, 67.

Relief of:

Charing Cross Bridge important for, 122.

Necessary, 37.

Restoration, effect on navigation, 80.

Royal Commission, appointment, 23, 24, 68.

Settlement:

Account of, and of remedial measures taken. 64.

Extent of, 1820 to March 1925 and March 1925 to July 1926, 71.

Temporary bridge, 64.

Traffic, 37.

Transverse section of, as existing, App. 5 (p. 95).

Underpinning:

"Free air", open cofferdam, method, advocated, 78, 208 (i); Gibb, App. 3 (p. 94).

a Practicable engineering proposition, 75

for 4 lines of traffic (35 feet):

Method should be considered by Royal Fine Art Commission, 91. Possibility of, without seriously affecting Rennie's design, 87-90. Recommendation, 84, 89, 91, 208 (i).

for 6 lines of traffic, not necessary or desirable, 83.

Sir Reginald Blomfield's proposal for, App. 5 (pp. 95-8).

Mr. Gedye's proposal, App. 5 (pp. 102-3).

Lengthening of tunnels, objection to, from point of view of navigation, 85, 86.

Mr. Muirhead's proposal, App. 5 (pp. 104-5).

Mr. Maurice Webb's proposal, App. 5 (facing p. 100, p. 100, facing p. 101).

Width, present, 82.

Works recommended, estimated cost, 194.

Webb, Maurice, F.R.I.B.A., proposal for widening Waterloo Bridge, App. 5 (facing p. 100, p. 100, facing p. 101).

Western Exits of London Society, schemes put forward by, and recommendation re, 155-8, 194, 208 (xv), App. 12.

Westminster Bridge:

Approaches, 137.

Charing Cross Bridge would relieve, 122, 137.

Description and dimensions, 136.

History, 7, 19.

Importance of, 137.

Relief necessary, 37.

Stability of, 136, 137.

Traffic and capacity and undesirability of increase, 136, 137.

Williams, Sir Owen, K.B.E., M.Inst.C.E., Charing Cross Bridge scheme, 128-32, App. 8 (pp. 109-11).

Woolwich:

Free Ferry:

Approaches, improvement recommended and cost would be small, 167, 194, 208 (xviii).

History, 7.

Interferences with service, 167.

Traffic, 37.

proposed High level bridge, 168.

Examination of scheme and not considered as within range of practical politics at present, 168.

Tunnel, 166.

History, 7.