

INDEX OF WITNESSES

	Page.
BARTHE ULRIC, Secretary, Quebec Bridge Co.....	4
Recalled	15
Recalled—documents produced.....	47
Recalled, further documents produced.....	63
Correspondence.....	427
BEAUVAIS, ALEX., Workman.....	193
BERGEN, EERNY, Assistant Engineer to Mr. Theodore Cooper.....	416
BRITTON, ED., Workman.....	132
CHASE, RICHARD, Workman.....	85
CLARK, HORACE N., Foreman storage yards.....	147
COOPER, THEODORE, Consulting Engineer for Quebec Bridge Co.....	343
Re-examination.....	406
CODWORTH, FRANK, Resident Engineer. Instrument work.....	22
Recalled.....	30
Recalled.....	79
Recalled.....	252
Recalled.....	317
CULBERT, C. L., Workman.....	82
DAVIS, CHAS., Workman.....	208
DEANS, JOHN STERLING, Chief Engineer Phoenix Bridge Co.....	8
Recalled.....	15
Recalled.....	306
Recalled.....	319
Re-examination.....	369
See also page.....	423
DOUGLAS, ROBERT C., Bridge Engineer, Department of Railways and Canals.....	332
EDWARDS, E. L., Inspector of Materials at Mills and Shops.....	138
Re-examination.....	358
ESMOND, MICHAEL, Workman.....	90
GINGRAS, AIME, Message boy.....	167
HALEY, D. B., Workman.....	105
Recalled.....	119
HALL, INGWALL, Workman.....	99
HOARE, EDWARD A., Chief Engineer Quebec Bridge Co.....	49
Recalled.....	64
Recalled.....	78
Recalled.....	117
Recalled.....	134
Recalled.....	244
Recalled.....	266
Recalled.....	275
Recalled.....	317
Re-examination.....	396
Re-examination.....	418
HUOT, JOSEPH ADOLPHE, Timekeeper.....	74
Recalled.....	80
JOHNSON, JAMES, Workman.....	96
JOHNSON, E. V., Inspecting Engineer, Department of Railways and Canals.....	330

	PAGE.
KINLOCH, E. R., Workmanship and General Erection Inspector.....	40
Recalled.....	212
Recalled.....	244
Recalled.....	301
Recalled.....	316
Recalled.....	403
Re-examination.....	420
Re-examination.....	432
Re-examination.....	134
LACHAPELLE, THEODORE, Workman.....	168
LAFRANCE, RAOUL, Workman.....	211
Recalled.....	205
LABARGE, OSCAR, Workman.....	185
LAJEUNESSE, DELPHISE, Workman.....	92
LAJEUNESSE, EUGENE, Workman.....	88
LEFEBVRE, JOSEPH, Workman.....	136
LEFEBVRE, DESIRE, Workman.....	130
MCCUMBER, DOMINIQUE, Workman.....	34
McLURE, NORMAN R., Inspecting Engineer.....	46
Recalled.....	249
Recalled.....	291
Recalled.....	144
MESSE, IRVING W., Inspector, workmanship at shops.....	304
Recalled.....	22
MILLIKEN, A. B., Superintendent of Erection.....	172
Recalled.....	315
Recalled.....	316
Recalled.....	171
NADSAU, DONAT, Painter.....	156
NANCE, J. J., in charge of engine.....	365
NORRIS, FRANK P., Manager Phœnix Iron Works.....	421
PARENT, HON. S. N., correspondence.....	361
REEVES, DAVID, President of Phœnix Bridge Co.....	378
SCHMIDT, CHARLES, Assistant Engineer Phœnix Bridge Co.....	322
SCHREIBER, COLLINGWOOD, Consulting Engineer. Department of Railways and Canals....	160
SPLICER, JOHN E., Workman.....	385, 425
SWAPKA, PETER L., Designing Engineer Phœnix Bridge Co.....	80
WICKIZER, E. J., Foreman of Preparations.....	163
WILSON, PERCY, Workman.....	163

ANALYTICAL INDEX, QUEBEC AND OTTAWA SITTINGS

	Page.
<i>Alignment—</i>	
Of centre post taken when traveller moved (Cudworth).....	32
<i>Anchor Arm—</i>	
Flash on top chord attracted attention of Culbert.....	83
Seemed to rise at centre (Culbert).....	84
Break in iron plate, fourth or fifth panel (Chase).....	87
Stringers at third panel back from pier seemed to part (Johnson).....	97
Suggestion that it did not fall till after cantilever (Haley).....	106
For detailed references to defects, &c., by Mr. Kinloch and Mr. MoLure, see 'Defects.'	
Accident in Belair yard to chord 9-L (Clark).....	148
Repairs done in yard (Clark).....	149
Description of repairs (Clark).....	150
Repaired end of chord still intact (Clark).....	150
Report that A-9 was buckling (Clark).....	154
Length of time on false work (Milliken).....	175
Joints had come into proper position before riveting (Milliken).....	175
Main members of anchor arm which were not riveted time of accident (Milliken).....	177
No reason for chords 5 not being riveted (Milliken).....	177
Same answer applies to chords 9 and 10.....	177
Permanent metal floor of portion not complete (Milliken).....	178
Comment on Clark's evidence re repairs to chord 9-L (Milliken).....	178
Ribs in panel 10 coming together (Beauvais).....	195
<i>Barnes, John Hampton—</i>	
General Counsel Phoenix Bridge Co., statement of position of company.....	3
<i>Barthe, Ulric—</i>	
Secretary Quebec Bridge Co. (testimony).....	4
Statutes and by-laws of company put in as Exhibit 1.....	4
Account of steps preliminary to construction.....	4
Calling for tenders.....	4
Contracts awarded for foundation and superstructure.....	4
Appointment of Mr. Hoare as Chief Engineer.....	4
Appointment of Mr. Cooper as Consulting Engineer.....	5
Specifications prepared by Quebec Bridge Co.....	6
Plans submitted to Mr. Cooper before contract.....	6
Recalled.....	47
Documents bearing on commencement of construction submitted (Exhibits 2 to 20).....	47
Notes explaining these exhibits agreed on by counsel and forming concise history of initial steps.....	47
Recalled.....	63
Letters referring to appointment of Mr. Cooper filed.....	63
<i>Beauvais, Alexander—</i>	
Foreman of a riveting gang (testimony).....	193
Had been working on anchor arm.....	194
Riveting almost up to erecting gang.....	194
Was working inside chord at joint between panels 9 and 10, Montreal side, when bridge fell.....	201
Quebec side of joint riveted.....	193
Centre ribs in panel 10 coming together.....	195
Description of method of riveting a joint.....	196
Montreal side of joint badly bolted.....	197
Seven-eighths bolts used in riveting this joint.....	197
Two rivets broken and ribs bending in.....	199
Mr. Meredith said they were no worse than others.....	199
Ribs in chords in panel 9, Montreal side, bent close together.....	200
Was inside chord 10 when bridge collapsed and fell with chord.....	201
Bending of chord probably caused breaking of the two rivets.....	202
Jarring of bridge by pneumatic tools.....	202
All others of his gang lost lives.....	203
Yenser 'the right man'.....	204
Patch put on angle web of main post last summer.....	204
Reference to evidence (Kinloch).....	249

	PAGE.
Bolting—	
Description of method before riveting (Kinloch).....	42
Britton, Ed.—	
Electrician (testimony).....	132
Conversation between Yenser, Birks and McLure, re moving traveller.....	133
Statement of Yenser re buckling of lower chords.....	133
No personal knowledge of defects.....	134
Birks, A. H.—	
Resident Engineer of erection, Phoenix Bridge Co., (references to).	
Record and experience (Deans).....	19
Detailed duties (Milliken).....	27
Conversation with, re safety of Bridge (Haley).....	129
Thought 9-L left storage yards crooked (Clark).....	155
Might not have been on bridge at time of repairs to 9-L (Clark).....	155
Birks gave impression that it did not make much difference whether traveller was moved or not (McLure).....	269
Estimate of effect on A-9-L of moving small traveller (Hoare).....	279
Did not consider it dangerous (Hoare).....	280
Reports slight distortions at splice between chords 8 and 9 (Hoare).....	282
Thought bends were in chord before it went into the bridge (Hoare).....	283
Cantilever Arm—	
Suggestion that it fell before anchor arm (Haley).....	106
Four webs of lower chord of panel 8 bulging (Haley).....	107
Bulge at splice 9, Quebec side (Haley).....	107
Inside webs, lower chord, 6th joint out, turning (McCumber).....	130
Visit to chord 9 with Haley and Cook (Nance).....	157
Bend seen in chord (Spicer).....	162
Chord 9, Quebec side, bent (D. Lajeunesse).....	187
Nothing to indicate failure in (McLure).....	273
Time at which it was finished (Cudworth).....	292
(For detailed references to defects, &c., by Mr. McLure and Mr. Kinloch, see 'Defects'.)	
Chase, Richard—	
Scr'old gang (testimony).....	85
With Culbert at time of accident.....	85
Saw towers, traveller and engine fall.....	85
Saw traveller hit water.....	85
Duration of fall about four seconds.....	86
Repair of plate in anchor arm, 4th or 5th plate.....	87
Did not see cracked plate near shoe on main post.....	88
Chords—	
For reference to, see 'Anchor arm,' 'Cantilever arm' and 'Defects.'	
Clark, Horace M.—	
Foreman storage yard (testimony).....	147
Description of duties.....	147
No trouble handling pieces.....	147
Accident to chord section 9-L anchor arm.....	148
Repairs done in yard.....	149
Description of repairs.....	150
Repaired chord still intact.....	150
No daily inspection of yard by Quebec Bridge Co.....	152
Material sent from storage yard but not erected at time of collapse.....	152
Material returned to storage yard.....	152
Had heard that chord A-9 anchor arm was buckling.....	154
Mr. Birks thought chord was bent when it left yard.....	155
Mr. Birks may not have seen A-9 at time of repairs.....	155
Clark, Horace M. (References to)—	
Comment on evidence re repairs to chord 9-L (Milliken).....	180
Collapse of Bridge—	
Positions of witnesses of, fully set out in Exhibit 24	
Testimony of witnesses of :	
Beauvais, Alexander, foreman riveting gang.....	193
Chase, Richard, workman.....	85
Cudworth, Frank, engineer.....	292
Culbert, C. L., workman.....	82
Davis, Charles, erector.....	208
Esmond, Michael, workman.....	90
Gingras, Aime, message boy.....	167
Haley, D. B., workman.....	105
Hall, Ingwall, workman.....	99

	Page.
Cudworth, F. E.—	
Resident Engineer in charge of instrument work (testimony).....	30
Appointment and connection with Quebec Bridge.....	30
Method of receiving instructions.....	31
Lines and levels of masonry accepted before commencing superstructure....	32
Method of taking levels, &c., during construction of work.....	32
Official relations with Mr. Birks.....	33
Previous experience and record.....	35
(Recalled).....	77
Plan filed showing points in relation to bridge and parts of bridge (Exhibit 25). (Recalled).....	79
Assisted in preparation of Exhibits 30, 43 to 50, and 54 and 55.....	297
Anemometer sheets for season of 1907 up to and including August 29, filed as Exhibit 56.....	292
Equipment for taking wind records.....	292
Measurements of truss deflections.....	294
Movement of masonry,—equipment for determining levels.....	294
Check measurements for span.....	295
Regular observations of the general position of the truss after each movement of the traveller.....	296
Never observed any settlement or sidelong movements of bridge.....	297
What he saw when bridge fell.....	297
History of events leading up to collapse.....	298
Observations after collapse agree with those of Mr. McLure.....	299
Test to determine the geometrical relation between a vertical plane continuing the centre line of the bridge and axis to end of pins.....	299
(Recalled).....	317
Sketch showing method used in measuring between the anchor pier and main pier, south anchor arm, on September 17, 1907; plan showing location of the 24' pins September 27, 1905; photograph showing progress of erection at close of season of 1906 (Exhibit 62).....	317
Cudworth, F. E. (Reference to)—	
Daily examination of lines and levels (Milliken).....	27
Culbert, C. L.—	
On river shore at time of accident.....	82
Attention first attracted by flash or smoke on top chord of anchor arm.....	82
Davidson, W. H.—	
Counsel for workmen, statement of position of Unions.....	3
Davis, Chas.—	
Erector (testimony).....	208
Working on small traveller time of accident.....	208
Heard a crash away back on bridge and felt it sink.....	208
Bridge sank slowly at first.....	208
Heard men talking of defects and saw jacks between webs in a chord.....	209
Had seen cracked plate near shoe.....	209
Did not feel bridge more springy than usual day of accident.....	210
Had seen jacks in a chord.....	210
Appliances were first class.....	210
Deans, John Sterling—	
Chief Engineer Phoenix Bridge Co.	8
Organization of Phoenix Bridge Co. re Quebec Bridge.....	8
Sources of material.....	8
Inspection in shop.....	8
Shipment of material.....	8
Marking inspected material.....	9
Field organization.....	9, 19
Relative positions Mr. Birks, Mr. Yenser and Mr. Cudworth.....	10, 321
Mr. Yenser in final authority on bridge.....	10, 12
Relations between Mr. Milliken and Mr. Yenser.....	11
No change in erection engineers.....	12
Mr. Milliken or Mr. Yenser had power to act in emergency.....	12
Definite character of instructions.....	12
Changes in instructions for north side made after consultation with Mr. Milli- ken's department.....	13
Committee of engineers and erecting department prepared instructions, an un- usual proceeding.....	13
Erection plans informally passed on by Mr. Cooper and staff fully competent.....	13
Daily reports of progress of work.....	14
(Recalled).....	14
Power to dismiss Mr. Yenser, Mr. Cudworth or Mr. Birks.....	15
Mr. Cooper's power to stop the work.....	15
Erection blue prints did not affect any plan approved by Mr. Cooper.....	16
Mr. Cooper's power to alter specifications.....	17

SESSIONAL PAPER No. 154

	PAGE.
<i>Deans, John Sterling—Con.</i>	
Mr. Hoare's authority.....	18
Method of communicating changes in specifications.....	18
Records of Mr. Yenser and Mr. Birks.....	18, 19
Unital harmony among staff on bridge.....	19
Inspection could be made at any stage of construction.....	20
Inspection of materials made away from Phenixville.....	21
Duty of any one seeing defects to report them.....	21
Whole bridge under close observation.....	21
Decision in case of defect being found.....	21
Mr. Hudson probably on duty when chord A-9 was repaired.....	156
(Interjection in Milliken's evidence.)	
Phenix Bridge Co. not urged to extreme limit by Quebec Bridge Co. to push work this season.....	161
Supplementary statement.....	219
Methods adopted in designing and erection.....	319
Preliminary study.....	319
Shop details.....	319
False work.....	320
Travellers.....	320
Power—electric.....	320
Erection appliances.....	320
Storage yards.....	321
Erection programme.....	321
Special features.....	321
Field organization.....	321
(Interjection in Cudworth's evidence) care taken in setting shoes.....	300
(Recalled).....	306
Erection plant designed by engineering and erection department Phenix Bridge Company.....	306
Men in principal charge—	
Chief Engineer, Mr. Deans.....	307
Computing Department, Mr. Szlapka and Mr. Hudson.....	307
Erection Department, Mr. Milliken and Mr. Trotter.....	307
Engineer, Mr. Birks.....	307
Plan approved by witness.....	307
Mr. Wickiser general foreman on false work.....	307
Mr. Cudworth, representative of engineering department.....	307
Mr. Hudson on ground during erection of main traveller.....	307
Design contemplated facility of erection and safety.....	307
Mr. Scheidl assisted Mr. Szlapka.....	308
Mr. Birks substituted for Mr. Hudson on work.....	309
Qualification of Mr. Birks.....	309
Had every confidence in staff.....	309
Telephonic communication between Bridge and Phenixville.....	310
First serious report about trouble with chords received on morning of accident.....	310
Report from Mr. Birks, August 8, that centre ribs did not line in connection between 7-L and 8-L cantilever arm.....	310
Correspondence with Mr. Cooper, but matter not finally settled.....	310
Letter received on August 29 from Mr. Yenser inclosing one from Mr. Birks referring to chords 9-R and 8-R.....	310
Consultation with Messrs. Szlapka, Reeves, Edwards.....	312
Concluded that there was no immediate or possible ultimate danger.....	312
Field so advised by telephone.....	312
Conversation between Mr. Deans and Mr. Birks by telephone.....	312
'There has been no further movement in chords'.....	312
Mr. Birks thought bend had been in chord at time of erection.....	312
'We have moved traveller and gone on with erection'.....	312
Reported to Mr. Hoare.....	312
Mr. Birks instructed to watch the chord.....	312
Believes Mr. Birks justified in his conclusion that chord had some bend when erected.....	312
Considerations which weighed in instructing Mr. Birks and Mr. Yenser.....	312
Deferred final action pending conference with Mr. Cooper and Mr. McLure.....	312
Last reports previous to letter of August 23, received on August 23 and 24, indicated bridge was behaving as expected.....	312
Arrival of Mr. McLure in Phenixville.....	314
Conversation between Mr. Deans, Mr. Szlapka, Mr. Milliken and Mr. McLure.....	314
Mr. McLure mentions receipt of message from Mr. Birks.....	314
Discussion deferred pending receipt of Mr. Birks's letter referred to in message.....	314
Mr. McLure left office about 5.30 and news of wreck was received at 7.10.....	314
No communication from Mr. Cooper to the Phenix Bridge Co. since accident.....	315
Mr. Birks blue print erection notes (Exhibit 66).....	315
Defects—	
Duty of any one noticing, to report (Deans).....	21
None observed while checking men four times daily at work on bridge (Huot).....	78

	Page.
<i>Defects--Con.</i>	
Bend in 9 chord cantilever arm, Quebec side (E. Jajouneuse).....	93
Inside webs lower chord sixth joint cantilever arm turning (McCumber).....	131
Blue, an Indian, stated large lower chord on Quebec side strained (D. Lefebvre).....	137
Springiness of bridge the last day (Hall).....	103
Bulge in lower chord, panel 8, cantilever arm (Haley).....	107
Bulge in splice 9, cantilever arm (Haley).....	107
Bulges observed by Haley marked A, B and C on Exhibit 27-B.....	119
First information of, received by Mr. Milliken in letter from Mr. Yenser, Aug. 29 (Milliken).....	172
Patch put on angle web of main post last summer (Beauvais).....	204
Beyds in A-9-L anchor arm and 8 and 9-R cantilever arm (McLure).....	257
Defects in chord 9, anchor arm, and 8 and 9 cantilever arm called to Mr. Hoare's attention August 27 (Hoare).....	275
Latticing on chord A-9-L anchor arm slightly strained (Hoare).....	278
Repair of splice between chords 7 and 8, west truss of south cantilever arm (Hoare).....	280
Dish in top section of main section post.....	281
Slight distortions at splice between 8 and 9 reported by Mr. Birks (Hoare).....	282
Record of defects observed by Mr. Kinloch during construction (Kinloch).....	214
Masonry not dressed true for pedestals.....	214
Warp in Quebec shoe.....	214
Bend in chords 1, 2 and 3 of anchor arm, Quebec side.....	214
Parts inaccessible to paint.....	215
Chord A-9-L repaired in yard.....	216
Other chords with bends same as 1, 2 and 3.....	217
Paint not dry when surfaces riveted.....	219
Cracked angle in centre post section C-P. 6-R.....	221
Top sections C-P. 1-R and C-P. 1-L slightly dishd.....	222
Slight error in detail in one of top longitudinal struts.....	222
Compression of angles between P-50 and centre post indicated by crinkling of paint.....	224
Crack in plate connecting lateral plate and truss floor beam gussets to post P-4-R.....	225
Record of defects found by Mr. Kinloch immediately prior to collapse (Kinloch).....	226
Buckling of field splices of east centre rib, chords 7 and 8, cantilever arm.....	228
Curve of splice between chords 8-R and 9-R cantilever arm observed about August 20.....	227
Increased curvature in chord 8-R.....	230
Bend in chord A-9-L anchor arm.....	231
Bend in cross strut at foot of P-4 post.....	236
Lacing of chord A-9-L strained.....	237
Loose rivet in second tie angle from cover plate over splice 8 and 9 and west centre rib.....	237
Bend at splice of chords 9-L and 10-L anchor arm.....	247
Ribs did not match at foot of chord 10-L anchor arm and had to be jacked over.....	247
Slight error in punching on main diagonal, Montreal side.....	249
Record of shop errors found on field by Mr. McLure during erection (McLure).....	249
Batten plates on dummy chords A-O-O-R and L at connection to top of post P-1-R-L interfered with chords and had to be cut off.....	250
At connection of diagonal A-T-4 with top chord of truss floor beam A-F-B-8 anchor arm, 7 holes on each side of diagonal did not match floor beams.....	250
In connection between S-V-5-L on top of hanger A-U-T-5-Z-L anchor arm, two horizontal rows of holes did not match.....	250
Slight dish on top centre post section C-P-1-R and L.....	250
Top cover plates over centre posts C-P-R and L connecting top laterals on cantilever arm did not fit connecting angles in post sections.....	251
Warp in base plate of each shoe.....	251
In bottom transverse strut belonging to truss 4-B-F-B-9 of cantilever arm, end of connection plates had to be chipped.....	251
On end post of cantilever arm, plate lapping over chord extended too far and had to be chipped.....	251
In tops of end posts on cantilever arm, outstanding legs of four vertical stiffener angles had to be chipped to admit connecting link.....	251
Crack in finished plate for bottom strut of truss floor beam F-B-8 at foot of post P-4, south anchor arm.....	252
Outstanding leg of third lattice angle from top bend on transverse diagonal 671-T-71, south cantilever arm cracked.....	252
Bend of plates between centre post and S-P-5.....	252
Deformation in compression members in advance of erection.....	253
Bend in splice between chords 7 and 8, cantilever arm.....	255
Failure to line at splice between chords 8 and 9-L.....	255
Several errors in lining on anchor and cantilever arms.....	255
<i>Douglas, Robert C.--</i>	
Bridge Engineer, Department of Railways and Canals.....	332
Went over specifications with Mr. Hoare.....	332
Not officially referred to him.....	333

SESSIONAL PAPER No. 154

	Page.
<i>Douglas, Robert C.—Con.</i>	
Approval not given on advice from him.....	333
Specification for tendere and not for construction.....	333
Instructed to examine sub-structure.....	333
Considered Quebec Bridge merely as a subsidised bridge.....	333
Amendments of Mr. Cooper to specification of 1908.....	334
Report dated July 9, 1908, upon proposed amendment.....	334
Objection to changes.....	335
Original contract governed.....	335
Too important to be left to judgment of Mr. Cooper.....	335
Consulting engineers.....	336
Correspondence with Mr. Hoare and Mr. Wolfal, Chief Engineer, American Bridge Co.....	336
Personal letter from Mr. Hoare, June 15, 1908.....	337
Amendments agreed upon by Mr. Cooper and Mr. Schreiber without consultation with Mr. Douglas.....	337
Examination of detailed plans.....	337
Order in Council, August 15, 1908, approving change in live loading.....	338
Notes made in 1908 with regard to large span bridges (Exhibit 67).....	340
Method of examining plans.....	341
Plans correct and well drawn.....	341
Mr. Schreiber takes the responsibility.....	342
Appointment of resident engineer not proposed.....	342
Only visited bridge during work on substructure.....	343
Regular procedure in regard to subsidy bridges followed.....	343
<i>Edwards, E. L.—</i>	
Inspector materials at mills and shops for Quebec Bridge Co. (testimony).....	138
Appointed May 1904, by Mr. Cooper with consent of Mr. Hoare.....	138
Instructions given verbally.....	138
Specifications used in inspection were Quebec Bridge Company's, Mr. Cooper's of 1904, and certain extra tests.....	139
These specifications received from Phoenix Bridge Company.....	139
Special tests of eye bars incorporated by Mr. Cooper in article (proceedings Am. Soc. Civil Engineers, 1906, Vol. XXXII., No. 1, page 14).....	140
Reports of tests of material (Exhibit 28).....	140
Record and experience.....	141
Little unfabricated material needed to be rejected by him.....	142
Inspection of fabrication continuous at shop.....	142
Some members sent back from finishing department.....	142
Chief complaint from field referred to painting.....	142
Method of checking shipments.....	142
Number of tapes rejected.....	143
Unusual pains taken with loading.....	143
Instructions from Mr. Hoare and Mr. Cooper re standard of inspection.....	144
Change in eye bar specifications.....	144
<i>Edwards, E. L. (Reference to)—</i>	
Description of duties (Hoare).....	59
<i>Emond, Michael, boatman (testimony)—</i>	
Between 10th and 11th panel of caisson time of accident.....	90
Description of collapse.....	91
Main traveller fell straight out.....	91
<i>Erection Appliances (Deans).....</i>	320
Special features in connection with (Deans).....	321
<i>Erection plans—</i>	
Prepared by Phoenix Bridge Co. and perhaps submitted to Mr. Cooper (Hoare).....	61
Supplied to Quebec Bridge Co. by Phoenix Bridge Co. (Hoare).....	61
<i>Eye Bars—</i>	
Article by Mr. Cooper on special tests (Proc. Am. Soc. Civil Engineers, 1906, Vol. XXXII., No. 1, page 14).....	144
Change in low limit from 60,000 to 62,000 pounds (Edwards).....	144
<i>False Work—</i>	
Special features of (Deans).....	320
<i>Field Organisation (Deans).....</i>	321
<i>Failure—</i>	
Belief that it took place in bottom chord (McLure).....	274
Likely first in chord 2-L or 2-R (McLure).....	274
<i>Gingras, Amédée—</i>	
Message boy (testimony).....	167
Near office at time of accident.....	167
Had heard bridge was going to fall.....	167
Had seen nothing dangerous.....	167

	Page.
<i>Haley, D. B.—</i>	
Bridge worker (testimony).....	105
On end of jib of traveller over 4th panel, cantilever arm, time of accident.....	105
Suggestion that cantilever arm fell off and anchor arm fell afterwards.....	106
Bulge at splice 9, cantilever arm.....	107
Condition of joints, cover plates, &c.....	110
Measured variations with Mr. Ward and Mr. Cook.....	111
(Recalled).....	119
Mr. Yenser afraid of bridge.....	125
Ordinary care used in erection and appliances good.....	126
Mr. Yenser not in supreme charge.....	126
Yenser moved traveller against his own judgment.....	127
Report of conversation between Yenser and Birks re traveller.....	127
Removal of traveller slow owing to shortage of men and bad weather.....	127
Reasons for shortage of men.....	128
Strike on work August 8.....	128
No question of safety involved.....	128
Statement by Yenser that his life was in danger as well as others.....	129
<i>Hall, Ingwall, bridge contractor (testimony)—</i>	
Working on top of main traveller time of accident.....	99
Traveller being taken down.....	100
Main traveller resting on bottom chords of bridge.....	101
Description of accident.....	101
Bridge fell as if tipping on an axle.....	102
Saw no defects personally.....	102
Springiness of bridge the last day.....	103
<i>Hoare, Edward A.—</i>	
Chief Engineer, Quebec Bridge Co. (testimony).....	49
Appointed by directors Quebec Bridge Co.....	49
Employed on first surveys in 1898.....	49
Agreement, 1900, for services until completion of work.....	49
Record and experience.....	50
Powers and duties as Chief Engineer, Quebec Bridge Co.....	51
Tenders received for building bridge.....	52
Change in specifications from 1,600 to 1,800 ft. span.....	53
Understanding that limited modifications in specifications would be made after contract signed.....	54
Amendments to specifications prepared by Mr. Cooper.....	55
Conferences with Mr. Cooper.....	56
Specifications as amended by Mr. Cooper final.....	56
Contract June 19, 1903, between the two companies defined his powers (Exhibit 16).....	57
Appointment of Mr. McLure.....	58
Mr. McLure's duties (Exhibit 22).....	58, 59
Duties of inspectors of mill and shop work.....	59
Importance of inspection in storage yard.....	60
Metal inspected both at yard and bridge.....	60
Dimensions of members checked by Mr. Birks and Mr. McLure on cars.....	60
Mr. Kinloch responsible to Mr. Hoare.....	60
Mr. Kinloch's duties chiefly detail work.....	61
Relations between Mr. Kinloch and Mr. McLure.....	61
Powers and duties of Mr. Kinloch.....	61
Authority to stop work not conferred on him by contract.....	63
(Recalled).....	64
Authority to stop work, previous statement qualified.....	64
Field diary kept by Mr. McLure.....	64
Personal visits to bridge.....	64
Proportion of his time devoted to Quebec Bridge.....	64
Method of making inspections.....	65
Final and most important inspection on bridge itself.....	66
Respective authority of Mr. Cooper and Mr. Hoare and Phoenix Bridge Co.'s engineers.....	66
Modifications in specifications, effect on cost.....	66
Final responsibility for original specifications rested with him.....	67
Mr. Cooper absolute authority on modifications.....	67
Preparation and approval of plans of bridge.....	68
Specifications based on standards.....	68
Mr. Cooper's decision re inspection of material final.....	69
Phoenix Bridge Co. primarily responsible for erection.....	69
Erection plans submitted to Mr. Cooper.....	70
Quebec Bridge Co. took ground that responsibility for erection methods lay with Phoenix Bridge Co.....	70
Reasons for appointing Mr. McLure.....	72
No claim to be expert on bridge construction as speciality.....	73

Hoare, Edward A.—Con.

No recommendation made for appointment of bridge specialist to remain on ground.....	73
Phoenix Co. authorized to use Mr. Cooper in any way.....	73
Mr. Cooper's visits to bridge.....	73
Quebec Co. relied for protection on engineer resident in New York.....	73
Personal interviews with Mr. Cooper.....	73
(Recalled).....	78
Considered reply to question of need of specially qualified resident engineer.....	78
(Recalled).....	117
Considered reply to question re personal visits to bridge.....	117
Record and experience.....	118
(Recalled).....	184
Certified copies of plans of bridges put in as Exhibit 33-A, 33-B, 33-C and 33-D.....	184
(Recalled).....	244
Agreement between Province of Quebec and Quebec Bridge Co. filed and marked Exhibit 36; agreement between city of Quebec and Quebec Bridge Co. filed and marked Exhibit 37.....	244
(Recalled).....	266
Files monthly progress estimates and diagrams (Exhibit 42).....	266
(Recalled).....	275
Defect in chord 9, anchor arm, and 8 and 9, cantilever arm, called to his attention August 27.....	275
System of daily reports.....	275
Telephonic communication with bridge.....	276
Office and field diaries.....	276
Movements in regard to bridge work from August 20 to August 29.....	277
Positive he was there on 28th.....	277
Mr. McLure's absence through illness.....	277
Deflections in ribs of chord 9-A reported by Mr. McLure to Mr. Hoare and Mr. Cooper, and by Mr. Birks to Phoenixville.....	278
Mr. McLure instructed to go to New York but before going to examine bridge..	278
Went to bridge morning of Aug. 28, and met Messrs. McLure, Kinloch and Birks.	278
Everything reported 'in perfect condition'.....	278
Latticing on chord A-9-L slightly strained.....	278
Mr. Yenser's reasons for moving traveller 'too many men out'.....	278
Mr. Yenser seemed to be quite at ease.....	279
Mr. Birks' estimate of effect on A-9-L of moving small traveller.....	279
Mr. McLure told to hurry off to New York and Phoenixville.....	279
Made no personal examination of parts under discussion.....	279
Total stress on chord A-9-L about 11 or 12 million pounds.....	280
Mr. Birks did not consider it dangerous.....	280
Repair of splice between chords 7 and 8, on west truss, south cantilever arm.....	281
Still undecided when bridge collapsed.....	281
Dish in top section of main centre post.....	281
Seldom corresponded with Mr. Cooper.....	281
What Mr. Yenser actually said.....	282
Further conversation with Mr. Birks.....	282
Slight distortions at splice between chords 8 and 9 reported by Mr. Birks.....	282
Mr. Birks reports nothing visibly wrong with latticing.....	282
Mr. Kinloch sent to storage yard to get information about previous repair of chord A-9-L.....	283
Returned to Quebec about 4 p.m.....	283
Mr. Birks thought bends were in chord A-9-L before it went into bridge.....	283
Birks said, 'I do not think it a serious affair'.....	284
Movements on the 29th.....	284
Did not visit the bridge and did not telephone.....	284
Expecting to hear from Phoenixville or New York.....	284
Telegram from Mr. Deans.....	284
Daily information by telephone from bridge.....	285
Ten hours elapse between discovery of deflection and reception of report.....	286
Would have required more information before taking action on an immediate report.....	286
Opinion on movement of traveller.....	287
Gave no definite instructions regarding the matter.....	287
Believed that no iron was to be erected.....	287
Not consulted when iron was added to panel.....	288
Repairs to chord A-9-L examined by Messrs. Hudson, Hoare, Kinloch and Szlapka in July, 1905.....	289
Chord was straight and in good condition then.....	289
Made no personal calculations as to increase of strain by moving traveller.....	289
Gave no further instructions after asking Mr. Birks to make second examination of chord A-9-L on 28th.....	290
No inspection of chord 9-B-A.....	290
Plans sent in with tenders.....	290
(Recalled).....	317
Statement in explanation of previous evidence.....	317

	Page.
Hoare, Edward A. (References to)—	
Final instructions from, expected by Mr. Deans (Deans).....	18
Responsibility of (Deans).....	18
Appointment as Chief Engineer (Barthe).....	4
Appointment of Mr. McLure (with Mr. Cooper) (McLure).....	34
Verbal instructions to Mr. McLure.....	35
Reliance on Mr. Cooper's decision (McLure).....	36
Hudson, Mr. (References to)—	
Assistant Engineer probably on bridge when 9-L repaired (Deans).....	156
Examined repairs to chord A-9-L in storage yard, July, 1905 (Hoare).....	289
Huot, Joseph A.—	
Timekeeper, Phoenix Bridge Co. (testimony).....	74
Position of men on bridge on day of accident.....	74
(List filed as Exhibit 24).....	74
On anchor arm when bridge collapsed.....	74
Ran up collapsing span to approach span.....	74
Attention first attracted by breaking of compressor pipe line.....	76
Position of riveters.....	77
(Recalled).....	80
Description of markings on Exhibit 24.....	80
Inspection:—	
Phoenix Company's inspector of material at works (Deans).....	8
Quebec Bridge Company's inspectors at works, Mr. Edwards and Mr. Meeser (Deans).....	9
Method of marking inspected material (Deans).....	9, 19, 41
Inspection after leaving works (Deans).....	20
No systematic inspection of material just before erection.....	21
Mr. McLure at first assisted shop inspectors (McLure).....	34
Mr. Kinloch's system of (Kinloch).....	41
No report reached Mr. Kinloch of what pieces passed inspectors at Phoenixville (Kinloch).....	41
Mr. Kinloch inspected on blue print instructions (Exhibit 60) (Kinloch).....	42
General oversight of structure by Mr. Kinloch (Kinloch).....	45
Of material at mills and Phoenixville (Hoare).....	59
Method of Mr. Hoare when visiting bridge.....	65
Final and most important took place on bridge itself (Hoare).....	66
Mr. Cooper's decision re inspection final (Hoare).....	69
Duties and powers of Quebec Bridge Company's inspectors (Hoare).....	71
Reasons for appointment of Mr. McLure (Hoare).....	72
Mr. Edwards, inspector of material at shops, appointed by Mr. Cooper (Edwards).....	138
Reports on workmanship at mills and shops written to Mr. Hoare, verbal to Mr. Cooper (Edwards).....	139
Little unfabricated material needed to be rejected (Edwards).....	141
Of fabrication continuous at shops.....	142
Method of checking shipments.....	142
Tapes rejected for shop use.....	143
Method of taking long measurements at shop (Meeser).....	145
No trouble in enforcing carrying out of specifications re manufacture (Meeser).....	147
Close inspection of erected members duty of Quebec Bridge Company's inspectors (Milliken).....	180
Reliance on Quebec Co.'s inspectors (Milliken).....	181
Instrument work—	
Description of methods during construction (Cudworth).....	31
Method of taking observations (McLure).....	38
Johnson, James—	
Foreman of bull gang (testimony).....	96
On ground, 15 feet west of second panel point, anchor span, time of accident.....	97
Stringers on chord third panel back from pier on anchor span seemed to part....	97
Saw no defects.....	99
Johnson, E. V.—	
Inspecting engineer of subsidized railways (testimony).....	330
Visited bridge about once a month to make progress estimates.....	330
Determined quantity rather than quality of work.....	331
Kinloch, E. B.—	
Workmanship and General Erection Inspector (testimony).....	40
Appointed by Mr. Hoare and reported to him verbally.....	40
Twice employed on Quebec bridge.....	40
On the work during erection of approach and anchor spans.....	40
Description of routine work.....	41
Duties on storage yard only occasional.....	41
No report from Phoenixville inspectors of pieces passed by them.....	41

SESSIONAL PAPER No. 154

Kinloch, E. R.—Con.

	PAGE.
No riveting until long after erection.....	42
Temporary boltings checked for sufficiency.....	42
Practically all chord joints bolted.....	42
No actual authority over workmen, but recommendations generally adopted.....	43
Some things he suggested not done.....	43
(Further explanation at page).....	236
Record of experience.....	44
No authority to order work stopped.....	45
(Recalled).....	212
What he actually observed when bridge fell.....	212
Entering office when he heard noise.....	212
Portal inclined slightly and trembling.....	212
End post on Quebec side trembling.....	213
Centre post peaks settled straight down.....	213
Noticed no bulging either way.....	213
Rails pulled outward along bridge.....	213
Saw no indication of where initial fracture occurred.....	213
Defects in material and workmanship during construction. (See 'Defects' for detailed index).....	214
Method of riveting.....	219
Examination of structure prior to collapse. (See Defects).....	226
Observed bend in splice between chords 8 and 9, cantilever arm, about Aug. 20....	227
Lining of centre ribs.....	229
Seemed to have increased a day or two later.....	230
Kept close watch of chords 8, 9 and 10.....	231
Discovered bend in chord A-3-L, anchor arm, Aug. 29.....	231
Called attention of Birks and Yenser to it.....	232
Measurements made by Kinloch and McLure.....	232
It was decided not to move out traveller pending instructions.....	232
Measured chords 8 and 9 in cantilever arm.....	232
McLure went to Quebec to see Hoare.....	232
No visible defects in chord 9, Quebec side, anchor arm.....	232
Thorough examination made of whole bridge.....	232
Next morning foreman had orders to move traveller.....	233
Traveller moved out.....	233
Two sections bottom chord, suspended span ready for bolting 15 or 20 minutes before collapse.....	233
McLure goes to New York to explain matter to Mr. Cooper.....	234
Mr. Hoare visits bridge Wednesday, 28th.....	234
Last inspection made of chords about 4 p.m., Thursday, 29th.....	234
Thought there was something seriously wrong with chords.....	235
Mr. McLure and Mr. Birks make calculations as to effect of moving traveller.....	238
Mr. Yenser not satisfied with results of calculations.....	238
Conversation of men on bridge about chords in anchor arm.....	239
Visits of Mr. Johnson, Government Inspector.....	239
Disagrees with Mr. Haley as to description of bends in chord 8-R, as shown on Exhibit 27-B.....	240
Inspections by Mr. Hoare.....	240
Detailed working plans and appliances amplified.....	241
Prepared by men who thoroughly understood bridge erection.....	241
Instructions as to when riveting should be done.....	242
No lack of riveters.....	243
Identification of members after collapse.....	243
Assisted in taking photographs marked Exhibit 34, and himself took photographs marked Exhibit 35.....	243
(Recalled).....	244
Explanation of evidence of Delphis Lajeunesse.....	244
Condition of riveting in main diagonals.....	246
Bend at splice of chords 10-L and 9, anchor arm.....	247
Ribs did not match at foot of chord 10-L, anchor arm, and had to be jacked over.....	247
Mr. Scheidl visits work.....	247
Beauvais' evidence; reference to.....	249
Failure of rivets after driving.....	249
(Recalled).....	265
Inspection of members on car.....	265
(Recalled)—	
In A-4-L chord, 8 feet from field splice with A-3-L are two plates between two outside west ribs.....	301
Three oak blocks with small plate between two east ribs 8 feet back from field splice A-3-L and A-4-L.....	301
Supposed blocks were used for spacing the webs.....	301
Method of determining when joints were tight.....	302
Movement of erection stringers before collapse.....	303
Switch connections between tracks on bridge.....	304

	Page.
<i>Kinloch, E. R.—Con.</i>	
(Recalled)—	
Statement (Ex. 61) as to riveting (Milliker) believes to be correct.....	316
re-examination.....	403
".....	420
".....	452
<i>Kinloch, E. R. (References to)—</i>	
Directions for riveting (Milliken).....	29
Duties at storage yard (McLure).....	37
On the work very often (Beauvais).....	197
'Standing there all the time' (Lebargé).....	207
Relations with Mr. McLure (Hoare).....	61
No power to order departure from blue print directions (Hoare).....	62
Duties and powers (Hoare).....	62
Sent to storage yard to get information about repair of chord A-9-L (Hoare).....	283
<i>Keenan, Mr. (Reference to)—</i>	
Mill inspector at Harristurg (Hoare).....	59
<i>Lebargé, Oscar—</i>	
Erector (testimony).....	205
Working on top main traveller.....	205
Had heard of bent chords but had seen none.....	205
Did not remember that horizontal strut on 9th panel point was riveted.....	206
Yenser had good ideas but sometimes got excited.....	207
Careful in raising iron, &c.....	207
Mr. Kinloch 'standing there all the time'.....	207
Description of his fall with bridge.....	207
<i>Lajeunesse, Eugène—</i>	
Bridge worker (testimony).....	92
At the main post, panels 4 and 5, anchor arm, time of accident.....	93
Saw bend in 9 chord, cantilever arm, Quebec side.....	93
Description of accident.....	93
Saw no crack in plate at shoe of centre post.....	95
<i>Lebvre, Désiré—</i>	
Crane operator storage yard (testimony).....	136
Told by Angus Blue, an Indian, that large lower chord on Quebec side was strained.....	136
Saw no other defects.....	137
<i>Lebvre, Joseph—</i>	
Day laborer (testimony).....	88
Thirty feet west of bridge and 100 feet from anchor pier time of accident.....	89
Heard loud noise near anchor pier.....	89
Saw no defects.....	89
<i>Levels—</i>	
Taken once each observation, Mr. McLure and Mr. Cudworth working together (McLure).....	38
<i>Loading—</i>	
Unusual precautions taken (Edwards).....	143
Drawings made for loading large members (Measer).....	143
<i>Lachapelle, Théodore—</i>	
Erector (testimony).....	134
Saw nothing wrong about shoe on pier or in other parts of structure.....	135
<i>Lafrance, Raoul—</i>	
General assistant (testimony).....	168
Saw crack in a plate on lower part of a pier.....	168
(Photograph showing shoe indicated, marked Exhibit 29).....	169
Mark placed on back of photo. to locate crack.....	170
Witness ordered to proceed to bridge and locate crack.....	170
(Recalled).....	211
Unable to find plate previously described as being cracked.....	211
<i>Lafrance, Raoul (Reference to)—</i>	
Reference to his evidence re cracked plate (McLure).....	253
<i>Lajeunesse, Delphis—</i>	
Erector (testimony).....	184
Working at point marked 'L' on Exhibit 36 on day of accident.....	185
Description of collapse.....	186
Saw bend in chord 9, cantilever arm.....	187
Report that Mr. Worley said it was put in crooked.....	189
Observed bulge getting larger.....	189
Had worked at post 9-10, lower chord, anchor arm.....	190
100 rivets to be put in there.....	190

SESSIONAL PAPER No. 154

	Page.
<i>Lajeunesse, Delphis—Con.</i>	
Joint near panel point 9 all riveted up.....	191
Mr. Yenser told him to put bolts where chord 10, anchor arm, joined centre post, Montreal side, but they were not put in by witness.....	192
Did not see any cracked plates.....	193
<i>Lajeunesse, Delphis (Reference to)—</i>	
Explanation of his evidence (Kinloch).....	244
<i>Material—</i>	
Sources of (Deans).....	8
Inspection of (Deans).....	8
Assumed to be perfect leaving Phoenixville (Milliken).....	27
None rejected at bridge (McLure).....	36
Inspection of, at bridge to see not damaged in transit (Kinloch).....	41
Inspection of, at mills and Phoenixville (Hoare), (Edwards).....	58, 138
Mr. Cooper's decision re inspection final.....	69
On bridge at time of accident (Wickizer).....	81
Reports of tests at mills and shops (Edwards), (Ex. 28).....	141
Inspection of fabrication at shops continuous.....	143
Sent forward but not erected before accident (Clark).....	152
Returned from bridge to yard (Clark).....	153
None on bridge not erected at time of accident except working plant (Milliken).....	176
Fabricated material received in good condition from shop (Kinloch).....	218
Inspection of members by McLure (McLure).....	254
Inspection of material before being placed in bridge (McLure).....	284
<i>Masonry—</i>	
Lines and levels of, accepted before commencing superstructure (Cudworth).....	32
Contract for, awarded (Barthe).....	4
<i>Methods—</i>	
Adopted in designing and erection (Deans).....	319
<i>McCumber, Dominique—</i>	
Erector (testimony).....	130
Inside webs in lower chord, sixth joint out, cantilever arm, turning.....	130
Saw no other defects.....	131
<i>Milliken, A B.—</i>	
Superintendent of Erection, Phoenixville Bridge Co. (testimony).....	23
Duties defined.....	23
Responsibility to Mr. Deans.....	23
Other bridges under erection at same time as Quebec Bridge.....	23
Needles cantilever bridge, 666 feet span.....	23
Personal supervision work on Quebec Bridge.....	24
Checking erection plane.....	25
Unusual precautions taken.....	26
Mr. Yenser's system of work.....	26
Mr. Yenser's reports to Phoenixville.....	26
Personal examination of bridge.....	30
(Recalled).....	172
Last visit to bridge Monday, August 26.....	172
First information about defects in letter from Mr. Yenser, August 28.....	173
Telephone conversation with Mr. Yenser.....	173
His attention had not been drawn to chords in question previously.....	173
Ribs of chords not lining up when bottom cover plate removed not unusual.....	173
Straightening of chords, play permitted in side sections, &c.....	174
No exceptional difficulties with any of joints.....	175
Joints in anchor arm had come into proper position before riveting.....	175
No material, not erected, on bridge at time of accident except working plant.....	176
Main members of anchor arm which were not riveted time of accident.....	177
No reason for chords 9, 5 and 10, anchor arm, not being riveted.....	177
Permanent metal floor of portion anchor arm not complete.....	178
Comment on Clark's evidence re repaired chord 9-L.....	178
Would have looked to Mr. Birks for advice re condition of member showing deflection described.....	180
Mr. Birks' position as to origin of deflection shown in sketch.....	180
Close inspection of erected members duty of Quebec Bridge Co.'s inspectors.....	181
Reliance on Quebec Bridge Co.'s inspectors.....	181
Erection programme for the season.....	181
Mr. Yenser not endeavouring to live up to any time scheme.....	181
Sufficient men to carry on work safely, but more being secured to hasten work.....	182
Numbers of men brought to Quebec from United States points did no work.....	182
Yenser had full control of Phoenix force on bridge.....	183
Some minor members in railroad wreck in 1905.....	184

	PAGE.
<i>Milliken, A. B.—Con.</i>	
(Recalled).....	315
Statement showing condition of field riveting up to August 29, anchor and cantilever arms (Ex. 61).....	315
(Recalled).....	316
Statement indicating position of locomotive and cars, traveller and material to be erected on cantilever span on August 29 to be compiled.....	316
Damage to shell in wreck on Delaware and Hudson Railway.....	316
No effect on structure.....	316
<i>Meeser, I. W. Inspector of fabrication for Quebec Bridge Co. at shops (testimony)—</i>	
Method of taking long measurements.....	145
Drawings were correct.....	145
Drawings for loading large members.....	146
No trouble in having specifications lived up to.....	146
Assembling and riveting good.....	147
Employees of Phoenix Co. instructed to make bridge 'master job'.....	147
Care in handling plates while cooling.....	147
(Recalled).....	304
Explanation of blocks and plates found between ribs.....	304
Satisfied that every chord member shipped from shop was straight.....	305
Examination of chords at Belair.....	305
Order of the several operations in producing a chord in shop.....	305
<i>McRedith, Riveting Foreman (Reference to)—</i>	
Said chord 10 no worse than others 10 minutes before accident (Beauvais).....	199
<i>McLure, Norman B.—</i>	
Inspecting Engineer, Quebec Bridge Co., and Mr. Cooper (testimony).....	34
Appointment by Mr. Cooper and Mr. Hoare.....	34
Instructions from Mr. Cooper (read).....	34
Verbal instructions from Mr. Hoare.....	35
Reports to Mr. Cooper regularly made.....	35
Responsibility to Mr. Cooper and Mr. Hoare jointly.....	35
Monthly returns of material erected made to Mr. Hoare.....	35
Mr. Hoare relied on Mr. Cooper's decision.....	36
Description of monthly routine of work.....	36
No material rejected at bridge.....	36
Mr. Kinloch's duties at storage yards.....	36
Record diaries.....	36
No detailed reports on riveting.....	36
Method of taking observations.....	37
Record and experience.....	39
Power of dismissal in Mr. Cooper or Mr. Hoare.....	39
Paid by Quebec Bridge Co.....	39
(Recalled).....	46
Duty to report first to Mr. Cooper in emergency.....	46
Would report to Mr. Hoare at same time.....	46
Harmonious relations among those on bridge.....	47
(Recalled).....	249
Record of shop errors found in field during erection: (See "Defects").....	249
Confirms evidence of Kinloch.....	249
Shop work exceedingly satisfactory.....	252
Errors in dimensions and riveting very few.....	252
Never saw any cracked plates near base of centre post.....	252
Deformation in compression members in advance of erection not more than half an inch.....	254
Watched for subsequent deformations but did not find any.....	254
Bends in chord sections observed.....	255
Jacking ribs into position.....	256
Attention called by Kinloch to bends in chords A-9-L, anchor arm, and 8 and 9-E, cantilever arm.....	257
Absent on account of illness from August 17 to 23.....	258
Measurements taken of bent chords.....	258
Decided to report to Mr. Cooper and Phoenixville.....	258
Yenser did not propose to add more load until advised.....	259
Discussed the matter with Mr. Hoare.....	259
Mr. Hoare approved Mr. McLure's trip to New York and Phoenixville, and instructed him to examine all connections in bridge that could possibly have any relation to members under observation.....	259
Examination made by Mr. McLure and Mr. Kinloch and no further indications of trouble found.....	260
Mr. Yenser changed his decision.....	260
Traveller moved out.....	260
Nobody had any idea bridge was in danger.....	261
Went to Mr. Cooper's office in New York and explained matter to him.....	261

SESSIONAL PAPER No. 154

	Page.
<i>McLure, Norman B.—Con.</i>	
Instructed to go to Phoenixville.....	261
Mr. Cooper telegraphed to Phoenix Bridge Co. not to add more weight to bridge..	262
Telegram from Birks saying no positive evidence chord had buckled since erection.....	263
Conversation with Mr. Deane.....	263
Discussion suspended pending arrival of Birks' letter.....	263
Mr. Cooper instructed him to tell Mr. Deane chord must be repaired or strengthened.....	264
Saw Mr. Cooper on return journey and he said: 'Well, its that chord'.....	264
Inspection of material before being placed in bridge.....	264
Inspection of chord A-B-L.....	265
Instructions of Phoenix Bridge Co. in regard to erection.....	266
Removal of false work.....	266
Relation between movement of cantilever forward and closing of joints in chords. Mr. Birks gave impression that it did not make much difference whether traveller was moved or not.....	269
Calculations of increased stress due to movement forward of cantilever arm....	269
Failure entirely in steel work.....	270
Opinion as to the free or fixed-endedness of columns.....	271
Surveys of wreck.....	271
Plans of wreck.....	273
Observations on wreck.....	273
Nothing to indicate straining of tension members.....	273
Transverse bracing, lateral and floor systems, in pretty bad condition.....	273
Greatest damage in main compression members.....	273
Almost complete destruction of certain parts of vertical posts.....	273
Evidence of destruction of bottom chords in numerous places.....	273
Believed failure took place in bottom chord.....	274
(Recalled).....	291
Sketch showing present location of all lower chord members in anchor arm and description of lower chord members and floor beams put in (Exhibit 54).....	291
Memo. showing deflection of cantilever arm under wind November 12 and 16, 1906, (Exhibit 55).....	292
(Recalled).....	315
Statement (Exhibit 61) believed to be correct.....	316
<i>McLure, N. B. (References to)—</i>	
Appointment of (Hoare).....	58
Duties defined (Hoare).....	58
Relations with Mr. Kinloch (Hoare).....	61
Erection plans, &c., used in inspection (Hoare)..	61
Reasons for appointment of (Hoare).....	72
<i>Nadeau, Donat—</i>	
Painter (testimony).....	171
Stopped work at three on day of accident account of wind.....	171
Joe. Biron and others said something wrong day before collapse.....	171
<i>Needles, Cantilever Bridge—</i>	
660 feet span (Milliken).....	24
<i>Nance, J. J.—</i>	
Hoisting engine operator (testimony).....	156
Working on top of little traveller time of accident.....	156
Went to bottom with engine.....	157
Visited chord 9, cantilever arm, with Cook and Haley August 27.....	157
Saw nothing defective in bridge.....	158
Tackle good and methods best he ever saw.....	158
Had confidence in foreman.....	158
Noticed no unusual spring day of accident.....	158
<i>Phoenix Bridge Company—</i>	
Organization of Company re Quebec Bridge—	
(Deane).....	8
(Milliken).....	26
Inspection of materials (Deane).....	8
Sources of materials (Deane).....	8
Contract between Phoenix Bridge Co. and Phoenix Iron Company (Deane).....	8
Shipment of material (Deane).....	8
Storage of materials (Deane).....	9
Field organization (Deane).....	10, 321
Instructions to field force, blue print books (Exhibit 60) (Deane).....	11, 13, 14
Harmony among field force (Deane).....	11, 19
Relations with Mr. Cooper (Deane).....	11, 14
System of reporting progress of work (Milliken).....	14, 26
Power to dismiss Mr. Yenser, Mr. Cudworth or Mr. Birks (Deane).....	15

	Page.
<i>Phoenix Bridge Company—Con.</i>	
Submission of erection plans to Mr. Cooper (Deans).....	16
Erection blue prints did not alter plans, &c., approved by Mr. Cooper (Deans)..	17
Duties of Mr. Milliken, Superintendent of Erection (Milliken).....	22
Other bridges erected during work on Quebec bridge (Milliken).....	23
Erection Quebec Bridge commenced 1905 (Milliken).....	24
Contract with Quebec Bridge Co. 19th June, 1903 (Hoare).....	53
Employees instructed to make bridge master job (McLure).....	147
Finally responsible re erection (Hoare).....	69
Yenser had full control of field force (Milliken).....	183
(See also appendix 4, Report of Commission.)	
<i>Plans—</i>	
For building bridge, preparation and approval (Hoare).....	52
For erection followed and worked well (Wickizer).....	82
Certified copies of plans of bridge filed as Exhibits 33-A, 33-B, 33-C, 33-D (Hoare).	186
Plans of wreck deposited by Mr. McLure.....	272
Plans sent in with tenders (Hoare).....	290
<i>Preliminary Study (Deans).....</i>	319
<i>Power—Electric (Deans).....</i>	320
<i>Progress Estimates—</i>	
Monthly return made to Mr. Hoare by Mr. McLure (McLure).....	35
Prepared by Mr. Hoare (Hoare).....	65
Visits to bridge, re (E. V. Johnson).....	350
<i>Quebec Bridge Co.—</i>	
Collection of statutes and by-laws of company filed as Exhibit 1 (Barthe).....	4
Initial steps towards construction of bridge (Barthe).....	4
Approval of tenders and awarding of contracts (Barthe).....	4
Appointment of Mr. Hoare as Chief Engineer. (Barthe).....	4
Approval of specifications before letting of contract (Barthe).....	6
Mr. McLure, Inspecting Engineer, paid by (McLure).....	39
Exhibits and notes on them explaining initial steps, submitted by Mr. Barthe after agreement among counsel (Exhibits 2 to 26).....	47
Contract 19th June, 1903, with Phoenix Bridge Co.....	57
Relief for protection on engineer permanently resident in New York (Hoare)....	73
Not unduly urging Phoenix Co. to hasten completion of bridge (Deans).....	181
Contract Nov. 12, 1900 (Exhibit 12).....	48, 324
Contract Dec. 19, 1900 (Exhibits 13 and 14).....	48
Contract Oct. 19, 1903 (Exhibit 64).....	327
List of shareholders (Barthe).....	427
(See also appendix 3, Report of Commission.)	
<i>Records—</i>	
Wind taken care of by Mr. Cudworth (Hoare).....	67
Mr. McLure's field diary (Hoare).....	118
<i>Records and Experiences of Engineers, &c.—</i>	
Birks, A. H., Resident Engineer of Erection, Phoenix Bridge Co. (Deans).....	19
Cudworth, F. E., Resident Engineer in charge instrument work, Phoenix Bridge Co. (Cudworth).....	33
Kinloch, E. R., Inspector Workmanship and General, Quebec Bridge Co. (Kin- loch).....	44
Yenser, B. A., General Foreman, Phoenix Bridge Co. (Deans).....	18
Hoare, Edward A., Chief Engineer, Quebec Bridge Co. (Hoare).....	50
Written statement (Hoare).....	118
Edwards, E. L., Chief Inspector of Materials Mills and Shops (Edwards).....	140
<i>Reports—</i>	
System of (Hoare).....	275
On inspection of materials (Edwards).....	140
System re progress of work, Phoenix Bridge Co. (Deans).....	14
(Milliken).....	26
Of riveting made daily (Milliken).....	28
Reports of progress of work made to Phoenixville at stated intervals (Cudworth), By Mr. McLure to Mr. Cooper regularly made (McLure).....	31
Monthly progress estimates to Mr. Hoare by Mr. McLure (McLure).....	35
Or mill and shop work inspections and tests made to Mr. Hoare by Mr. Edwards.	58
Mr. Cooper kept informed of progress by Mr. McLure's reports.....	73
Package of inspectors' reports from Mr. Edwards at Phoenixville put in as Exhibit 28 (Hoare).....	119

	Page.
<i>Schreiber, Collingwood, C.M.G., formerly Deputy Minister and Chief Engineer, Department of Railways and Canals (testimony).....</i>	322
Quebec Bridge matter passed through his hands.....	322
Approved of general plan by Order in Council May 16, 1906 (Exhibit 2).....	322
Subsidy contract.....	322
Specifications submitted by Quebec Bridge Co.....	322
Tenders invited by Quebec Bridge Co.....	322
Agreement between Quebec Bridge Co. and Government, Nov. 12, 1900 (Exhibit 12).....	324
Mr. Cooper's position.....	324
Relied largely on Mr. Cooper.....	324
Detailed drawings referred to Mr. Douglas.....	325
Specifications attached to subsidy contract considered satisfactory.....	325
Amendments to specifications.....	325
Letter from Mr. Douglas criticising amendments.....	325
Amendments passed only after reference to Mr. Douglas.....	325
Proposal to employ bridge engineer.....	326
Mr. Cooper given a free hand.....	326
Order in Council authorizing the adoption of new loadings.....	326
Guarantee agreement between Quebec Bridge Co. and Government, Oct. 19, 1903 (Exhibit 64).....	327
Plans and specifications to be approved by Governor in Council.....	327
No Order in Council found showing such approval.....	327
Plans signed by Mr. Schreiber.....	328
Instructions to C. J. Tomney, inspector at Phoenixville.....	328
Mr. Cooper supposed to visit bridge frequently.....	329
Mr. Johnson visited bridge re progress estimates.....	329
Mr. Cooper had not authority to amend specifications.....	330
Specifications--	
On which tenders called for, prepared by Quebec Bridge Co. and approved by Order in Council (Barthe).....	6
Primary responsibility for original erected with Mr. Hoare (Hoare).....	67
Based on standard specifications (Hoare).....	68
Splicer, John E.--	
Erector.....	160
Not working day of accident owing to high wind and bent chord in cantilever arm.....	160
Foremen good men.....	162
Thought bridge was safe.....	163
Strike--	
On bridge August 8, reasons for (Haley).....	128
No question of safety of bridge involved (Haley).....	128
Telegraph strike made transmission of messages uncertain (Milliken).....	173
<i>Scheidt, Mr., visit to the bridge (Kinloch).....</i>	247
<i>Shop Details (Deans).....</i>	319
Storage Yard--	
Equipment (Clark).....	148
Accident to chord 9-L, anchor arm (Clark).....	148
Traveller (Small)--	
In position on third panel erected, cantilever arm, time of accident (Milliken).....	176
Traveller (Main)--	
Covered 8th panel cantilever arm, partly dismantled time of accident (Milliken).....	176
Fell straight out (Esmond).....	91
Moved by Yenser against his own judgment (Haley).....	127
Removal of, very slow (Haley).....	127
Being taken down day of accident (Hall).....	100
Rested on lower chords (Hall).....	101
Did not upset (Hall).....	101
Statement of Yenser re removal (Haley).....	128
<i>Traveller, Special Features (Deans).....</i>	320
<i>Tomney, C. J., Government Inspector at Phoenixville (Schreiber).....</i>	329
Vickiser, E. J.--	
Foreman of Preparations (testimony).....	80
On dock 56 feet behind main pier at time of collapse.....	80
Description of collapse.....	80
Material on bridge at time of accident.....	81

	Page.
<i>Wilson, Percy—</i>	
Labourer (testimony).....	163
Going ashore for rivets when bridge fell..	163
His gang of riveters all working on bottom chord, 300 feet beyond main pier.....	164
Positions of other gangs.....	164
Description of accident.....	166
Had observed nothing out of order.....	166
Had heard of cracked bottom chord near main pier..	166
<i>Wind—</i>	
Witness stopped work on account of (Nadeau).....	171
<i>Yenser, B. A. (References to)—</i>	
General foreman Phoenix Bridge Co., record (Mr. Deans).....	18
Responsible man re erection (Deans).....	11
Authority to act after consultation with Mr. Birks (Deans).....	22
Reports to Phoenixville (Milliken).....	26
General supervision exercised (Milliken).....	26
Authority to order stoppage of work (Kinloch).....	45
Afraid of bridge (Haley).....	125
Understood his work (Haley).....	126
Moved traveller against his own judgment (Haley).....	127
Yenser, report of conversation with Birks re traveller (Haley).....	127
Statement re danger to his life (Haley).....	129
Same statement (Britton).....	133
Statement re buckling of lower chords (Britton).....	133
Letter to Phoenixville of Aug. 27 and 'phone conversation re proceeding with erection (Milliken).....	172
Not endeavouring to live up to any time scheme (Milliken).....	181
Had full control of entire Phoenix force on bridge (Milliken).....	183
Very conservative man (Milliken).....	183
Gave orders to put bolts where chord 10 joined centre post (D. Lajeunesse).....	192
'The right man' (Beauvais).....	204
Had good ideas but sometimes got excited (Lebargé).....	207
Yenser's reason for moving traveller, 'too many men out' (Hoare).....	279

INDEX OF PRINTED EXHIBITS

	PAGE.
9. Report of Mr. Theodore Cooper on tenders for substructure and superstructure.	439
11. Report of Mr. Theodore Cooper on modifications.....	446
18. Order in Council (15th August, 1903) with respect to powers and duties of Chief Engineer.....	447
34. Photographs (Mr. Cudworth).....	At end of this volume.
35. Photographs (Mr. Kinloch).....	At end of this volume.
70. Correspondence from Mr. Cooper's letter-books. (See chronological index to correspondence, page 448).....	452
71. Correspondence from Mr. Cooper's letter-books..	461
72. Correspondence from Mr. Cooper's letter-books..	474
73. Correspondence from Mr. Cooper's letter-books..	480
74. Correspondence from Phoenix Bridge Company's letter-books..	486
75. Correspondence from Phoenix Bridge Company's letter-books..	503
76. Correspondence from Phoenix Bridge Company's letter-books..	508
77. Correspondence from Phoenix Bridge Company's letter-books..	515
78. Correspondence from Phoenix Bridge Company's letter-books..	525
79. Correspondence from Phoenix Bridge Company's letter-books..	533
80. Correspondence from Phoenix Bridge Company's letter-books..	542
81. Correspondence from Phoenix Bridge Company's letter-books..	551
82. Correspondence from Phoenix Bridge Company's letter-books..	561
112. Instructions to Mr. Cooper to report on tenders.....	660
114. Statement of all payments to Mr. Cooper, Quebec Bridge Company.....	569
120. List of shareholders Quebec Bridge Company (evidence).....	427
122. Mr. Ami's report on geology of foundations.....	570
124. Photos of wreck taken by Mr. Francis.....	At end of this volume.
125. List of plans of bridge with important dates.....	578
126. Photographs of details and erection methods.....	At end of this volume.
127. Photographs of details and erection methods.....	At end of this volume.