

Mr. J. W. BARRY said, that in the Paper he had given the cost of the land of the Charing Cross Railway, including the City Terminus Extension, at £1,900,000, and the cost of the works at £1,200,000, making together £3,100,000. The price of the land was arrived at by Mr. Ryde, the Surveyor to the Company, after deducting the sums paid by the Company for the tolls of the Hungerford Bridge and of the Hungerford steamboat pier, which together amounted to £140,000, as well as the price of the shares held by the South Eastern Railway Company in the City Terminus and the Charing Cross Hotels, which together amounted to a further sum of £130,000, and after also taking credit for the surplus lands. He was anxious not to be understood as having given the total capital cost at which the Charing Cross Railway stood in the South Eastern Railway Company's books; because there were other miscellaneous items of expense, such as the loss of interest during construction, rates and taxes during construction, and legal and parliamentary expenses, amounting in all to about £600,000, which would have to be added if the real cost was to be given. Adding the value of the surplus lands, the price of the tolls, the price of the shares in the two hotels, and the miscellaneous expenses, the total capital cost of the Charing Cross Railway, including the City Terminus Hotel, amounted to £4,070,000. It was, however, fair to remark, that the tolls were still in existence, and produced a revenue; that the Charing Cross Hotel paid a dividend of from 10 to 12 per cent.; and that the surplus land was of value distinct from railway purposes. The freehold land possessed by the Company under the arches of the railway was also of great value, totally irrespective of the traffic, and was scarcely as yet developed. Mr. Ryde believed that the letting value of the land under the arches, capitalised at twenty years' purchase, would go a long way towards paying the cost of the viaduct, excluding, of course, the bridges over the roads; and the rent of the vaults under the station would, if similarly capitalised at twenty years' purchase, probably pay the cost of the station up to the formation level.

Mr. W. H. BARLOW said as an idea prevailed in some quarters, that the roof of the Midland Railway station at St. Pancras, had been more costly than other roofs of large span, he would take this opportunity of placing on record a few particulars with regard to that structure; and alongside the figures so given he would add, for the purpose of comparison, similar details as to the roof of the Cannon Street station. Owing to the roof of the St. Pancras station springing from the ground level, instead of from the top of the walls, the weight of the roof was not borne on the walls, and, therefore, the walls were made thinner.

COMPARATIVE STATEMENT.

	St. Pancras	Cannon St.
	Station.	Station.
	ft.	ft.
	in.	in.
Height of the walls above the rail-level	40 0	48 6
Average thickness of the walls above the rail-level	3 6	5 0
Span of the roof	240 0	188 6
Weight of principal, including spandril frame and wrought-iron foot, to the level of the floor-girders	52 tons.	
Weight of truss, commencing at the top of the walls		47 tons.
Distance from centre to centre of principals	29 ft. 4 in.	34 ft.
Area supported by one principal, measured on plan	7,040 sq. ft.	6,426 sq. ft.
Cost of each principal	£962	£1,128
Height from the rail-level to the upper side of principal	105 ft.	108 ft. 6 in.

The reason why in one case 50 tons were procured for the same cost as 40 tons in the other was, that, in the cheaper structure, the whole of the work was of common riveted bridge-iron, and did not involve screw cutting and boring. He had not given the price per square, because that included the cost of covering, which differed in the two cases. One part of Cannon Street station was covered with Muntz's metal, and the other part with glass. In the St. Pancras station there was a tie below the level of the rails, altogether irrespective of the roof, and in that way great depth had been obtained for, what he might call, the roof girder. That was an advantage which did not obtain when the roof sprang from the top of the walls. He had not included the weight of the tie, as it formed no part of the roof. When the station was decided upon, its level, being governed by circumstances over which there was no control, turned out to be 16 feet above the level of the road. The Directors and the General Manager then determined, that this space should be utilised for special purposes, and accordingly the substructure was composed of columns and girders. The result was a ready-made tie, and this was taken advantage of in designing the roof. He believed this was the first large roof of that construction.

Mr. J. T. HARRISON stated that the design he sent in for the building for the Exhibition of 1851 was similar in principle.

Mr. HAWKSHAW,—Past President,—remarked, that a roof was now standing in Bradford, which he constructed nearly twenty years ago, springing from the platform level; and he thought one had been erected on the Preston and Wyre Railway before that.

With regard to the cost of roofs, comparisons could not be usefully made, unless every particular was included. For instance, it appeared that in the roof of the St. Pancras station wooden sash-bars were to be used; whereas in the Cannon Street station roof the sash-bars were all of iron. No doubt in that way a large roof would be obtained at a moderate cost for its size, and he thought it would be a fine work. Again, the tie-bars across the whole width of the St. Pancras station served another and useful purpose.

In respect to the cost of the Charing Cross Railway, the Author had done what engineers were liable to do; he had denuded the capital account of several extraneous items. The cost of the work was known exactly; it was under £1,200,000; and Mr. Ryde, the surveyor, by deducting the items that had been mentioned, had cut down the cost of property, which, from his point of view, might be right. Still, having to deal with what stood in the books of the company, Mr. Hawkshaw did not think it would be proper to let it go forth that the Charing Cross Railway, including the Cannon Street extension, had been made for £3,000,000. It, in fact, in round numbers had cost £4,000,000. That sum, no doubt, provided for the items mentioned, and a good deal of surplus land; indeed on some portions of the line there was room for three, and in others for four lines of way. He would not pretend to value that surplus land; but he thought it right to state that the whole of the property, including the spare land, the pier and bridge tolls, &c., cost about £4,000,000. That exceeded the Parliamentary estimate, but that estimate was for a work of less magnitude; in the first place, it was for two lines of way, while three had been laid, and four provided for. The Charing Cross Bridge had been widened from two to four lines, and the Cannon Street Bridge from two to five lines of way, and the stations were twice as large as originally intended.

Mr. Hood said the question was whether, in the cases both of the Cannon Street and of the St. Pancras roofs, an unnecessary outlay was not incurred to secure the advantage of one large span over the entire area. What was wanted in a station roof was good ventilation, plenty of light, and freedom from obstruction. He thought that a good roof could practically be constructed in stations of this character, which would secure the great points of simplicity, durability, and freedom from obstruction, at a much more moderate cost. He had seen nothing which led him to doubt, that the principle he had adopted in the construction of the Brighton Company's Victoria station was the correct one. There, a breadth of 240 feet was divided into two spans of 120 feet each, and the columns were put in the cab road, out of the way of danger from the chance of a train running off the line. The roof of that station was carried by transverse trussed girders, each 120 feet span, and placed 50 feet apart, so that the cross girders were each 50 feet span. The framing was entirely of iron, covered with boarding, $1\frac{1}{2}$ inch in thickness and iron-tongued, and slated, the slates being laid with a 4-inch lap; and iron sash-bars were used throughout. By adopting the principle of trussed girders, it did not matter where the columns were placed, because the girders could always be made uniform in appearance across the lines of railway, every part of such a structure was accessible, and could be renewed at pleasure, without interfering with any other part.

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Moreover, such a station could be enlarged without pulling anything down, by additions to the sides, and the columns could be moved by strengthening the girders. The roof of the Victoria station, where there was no thrust upon the walls, which were very light, had cost, over an area exceeding 3 acres, £17 per square of 100 feet measured on plan, as compared with nearly £50 for the roof of the Cannon Street station. To that £17 per square must be added about two guineas per lineal foot, for the longitudinal columns and girders, which would bring the total average cost to something under £20 per square of 100 feet. Although the lowest tender was accepted, everything was of the best description; the workmanship and materials were excellent, and the cost was increased by a certain amount of ornament in the details. He did not see how, with large spans, such as those at Cannon Street or at Charing Cross, the station could be widened without affecting the whole of the existing structures. He thought the Cannon Street station-roof might have been constructed at half the stated cost, if it had been divided into two spaces, and if the columns had been placed in the cab road, or on one of the platforms. He believed the arched roof belonging to the London, Chatham, and Dover Railway Company at the Victoria station cost a little more than that of the Brighton Company's station; although it must be borne in mind, that it was covered with zinc, that the rafters were of wood, and that it was nothing like so durable as a roof covered with boarding and slating.

Mr. J. A. LONGRIDGE thought the Author of the Paper was quite right in giving the cost as an engineering work, although Mr. Hawkshaw might also be right in wishing to explain that £3,000,000 did not represent the real cost to the Company. The line had cost £3,000,000; with the other £1,000,000 engineers had nothing at all to do.

Mr. R. P. BRERETON remarked, that the question of the size of roofs for stations had become one of grandeur and magnificence of appearance; but there was no actual necessity for the large spans which had recently come into fashion. Paddington station, which was some sixteen years old, was one of the first in which large and lofty spans of iron roofs without any ties had been introduced. There the centre span was 102 feet, and there were two side roofs with spans of about 70 feet each; and no inconvenience resulted from the supporting columns in the middle of the intermediate platforms. The Great Northern station at King's Cross had one of these roofs without a tie. It was found substantial so long as there was something more than a bare side wall to spring from; and in the case of the St. Pancras station there was, fortunately, not only a side wall, but about 20 feet of solid brick wall opposite to each rib, and he believed these

were what would have to be principally relied upon for support. The ties would probably not be required for any great service, and if they should ever become hot, they might rather assist in pushing out the roof. It was desirable that shareholders should not suppose that these grand and magnificent structures were altogether hopeless outlays. According to the Paper, about one-half of the passengers using the stations under discussion were local passengers, and the receipts from them would amount to about $2\frac{1}{2}$ per cent. upon the outlay. If that were so, after the first year there need not be complaints of extravagance and of money being thrown away. About thirteen thousand local passengers used those lines daily, and at four pence each, which was an average fare, this would yield $2\frac{1}{2}$ per cent. on the outlay.

Mr. HEMANS thought it would be desirable to put on record the comparative cost per square of the roofs of the stations at Cannon Street, Charing Cross, St. Pancras, Victoria, Lime Street, Liverpool,¹ and New Street, Birmingham.²

Mr. J. H. PORTER thought that the Birmingham station roof had cost about £30 per square. He entirely agreed that roofs of such enormous span were unnecessary, as the cost was evidently much greater as compared with that of roofs of less span. For all purposes of accommodation, and for the avoidance of all possible risks, he thought 120 feet spans ample; and it should be considered that the weight of the principals must be taken as very nearly the squares of their spans. He had built a roof for a structure in St. Petersburg of 140 feet span, the principals of which were at intervals of 14 feet, and weighed 9 tons each. This roof was designed abroad, and he compared its weight with the weights of other structures, and amongst others the Birmingham station roof, of which the weight of the principal of 212 feet span was about 24 tons. Taking the weight of the 120 feet span at one-fourth that of the 240 feet span, it was obvious that such great spans were extravagant. A similar covering would require deeper longitudinal framing for those very great spans, which, of course, was all in favour of the lesser span.

The large roofs that had been spoken of were: First, that of the City Terminus extension of the Charing Cross Railway, in which the principals were of 190 feet clear span, and spaced at intervals of $33\frac{1}{2}$ feet. Secondly, that of the Birmingham station, in which the principals were of 212 feet span, placed at distances of 24 feet from centre to centre. And, thirdly, that of the St. Pancras station of

¹ For a "Description of the Iron Roof over the Railway Station, Lime Street, Liverpool," by R. Turner, *vide* Minutes of Proceedings Inst. C.E., vol. ix. p. 204.

² For a "Description of the Iron Roof, in one Span, over the Joint Railway Station, New Street, Birmingham," by J. Phillips, *vide* *Ibid.*, vol. xiv. p. 251.

the Midland Railway, where the arches or ribs (not trusses) were of 240 feet span, the distance from centre to centre of the principals being 29 feet 4 inches, or say, 30 feet. As the two first-named were similar in the character of the trussing, and not very different in span, he proposed to compare the weights of their principals, and to apply the mean of those weights to a comparison with the St. Pancras roof. For this purpose they must be reduced to a common spacing and a common span. Let the spacing be that of the St. Pancras roof, or 30 feet; and let the span be one-half that of the St. Pancras roof, or 120 feet. In the first place $\frac{1}{11}$ th must be deducted from the $33\frac{1}{2}$ feet of the Cannon Street principal, and $\frac{1}{4}$ th added to the 24 feet of the Birmingham principal. In like manner a similar deduction must be made from the $47\frac{1}{4}$ tons of the one, and an addition made to the 25 tons of the other. The result would be 42.59 tons in the one case, and 31.25 tons in the other; and it would be noticed that the lighter weight was for the larger span, and *vice versa*. To reduce them to a common span of 120 feet—

Cannon Street	190 ² :	42.59 :	120 ² :	17 tons.
Birmingham .	212 ² :	31.25 :	120 ² :	10 tons.

The mean of these was thus $13\frac{1}{2}$ tons; and that accorded very nearly with what he had found, from his own calculations and practice, to be due to a principal of that span, if spaced at 30 feet, but he would prefer principals spaced at 15 feet, and of course weighing one-half, or $6\frac{3}{4}$ tons. Spaced at 15 feet there would be greater stiffness in the structure generally, with great reduction in the scantling and weight of the longitudinal framing connecting the principals. The weight of the rib or arch of the St. Pancras roof was 50 tons for the span of 240 feet. Now if two spans of 120 feet had been adopted, it would have been necessary to provide one column and one girder for each bay of 30 feet, as intermediate supports, the weights of which he estimated as follows:—

A column 30 feet high would weigh, say	3 $\frac{1}{2}$ tons.
A lattice girder 5 feet deep, of suitable stiffness, and adapted to carry the weight of 15-feet bays	3 ,,
Four principals, at $6\frac{3}{4}$ tons	27 ,,
	33 $\frac{1}{2}$..

so that in every bay of 30 feet there would have been a saving in weight of $16\frac{1}{2}$ tons, while the saving in the weight of the longitudinal framing would have been in nearly the same proportion. Although the arches of the St. Pancras roof were continued down to the ground, there was abundance of brickwork for the support of the roofs of 120 feet span, at a height of 30 feet.

Of course this argument applied with greater effect to roofs beyond 200 feet than to those within that span; and while he

considered spans of 120 feet ample for all purposes of accommodation, he recognised, for example, that it might be more desirable to construct one span of 150 feet than two spans of 75 feet.

Mr. J. W. GROVER remarked that the price of the Birmingham roof was £16 per square, and that the span varied from 191 feet to 212 feet. Every principal was different throughout, which in ordinary cases would have increased the cost; but, by a carefully-constructed table, each part was varied proportionately in such a manner as to cause very little trouble.

With regard to the weight to be put upon roofs, he had known instances where engineers had required a maximum of 80 lbs. to the square foot, which approached the requirements of a bridge, and 60 lbs. was common enough. He thought generally principals and covering gave a weight of about 20 lbs. to the superficial foot. The effect of wind was often much exaggerated; for if it produced a steady uniform pressure of anything like 30 lbs. or 40 lbs. to the square foot, as registered at particular spots by anemometers, the Crystal Palace ought to have been blown down long ago. The roof over the North Court of the Science and Art Department, at Kensington, covered 112 feet, both ways, without intermediate supports; four 112-foot girders intersecting each other were used. It was a complicated roof, being constructed to meet certain architectural features, without any ties at all, and that ran up the cost very materially. It was covered with Hartley's thick glass, a valuable covering, but one which weighed a great deal, and was costly: that roof had cost about £40 a square, and weighed 22 lbs. per superficial foot. He had found that the French engineers had gone carefully into the question of weight in connection with the first French Exhibition, and they allowed as little as 22 lbs. per square foot for the arched roof measured on the surface, with wind and snow combined. No tie-rods were used, because, as in the St. Pancras roof, the ribs practically abutted on the ground at both ends. It was well, however, to remember, that the French engineers seldom exposed the sections to high strains. In the building in question a maximum compressive strain of $2\frac{3}{4}$ tons per square inch seemed to have been adopted for the wrought-iron members. He believed that in the Birmingham station-roof the principals cost about the same as the covering, £8 a square being put down for the principals, and £8 for the covering. He had been told that the roof of the station at Worcester, where the spans were 80 feet, only cost about £12 a square; and there had been many roofs constructed of 60 feet span, which he believed was the cheapest form, for £10 or £12 a square.

Mr. HOOD said that, when constructing the Victoria Station roof, he had been informed by the Engineer of the Great Western Rail-

way, that the cost of the Paddington roof was £19 a square, exclusive of columns and girders.

Mr. E. RYDE stated that the actual money paid for land for the Charing Cross main line and station was about £1,362,000; that was to say, a sum of £560,000 was paid for land in Middlesex, and £802,000 for land in Surrey; but the former amount included the purchase money of the Charing Cross foot-bridge, which the Company were compelled to buy, although they did not want it. The bridge, which was earning upwards of £4,000 a year, was acquired at twenty years' purchase. During the construction of the station the tolls were not continued the same; but in future the bridge would probably earn 5 per cent. upon its cost. That, therefore, was a distinct property, and the two properties should not be confused with each other. It was a question whether railways in London would or would not pay, and to ascertain this, that which belonged to the railway must be separated from that which did not. The same observation applied to the Charing Cross pier dues, which were still received by the Company, except in so far as the Metropolitan Board of Works had interfered with them, and in that instance the Board had paid compensation. The £65,000 put down for shares in the Charing Cross Hotel, which shares Lord Redesdale compelled the Company to hold, represented an expenditure for land which would not have been required for the railway, including that occupied exclusively by the Hotel Company in Villiers Street. All these separate items of expenditure being deducted, left the cost of the land for the Charing Cross line proper and the Charing Cross station at £1,000,000, including land for a fourth line of way, and for a station at Waterloo, which the Company were shortly going to build. On the question of St. Thomas's Hospital, he only took credit for £150,000, which was the sum in cash for which the Company sold the surplus land; but they had a second mortgage on that property for an additional sum of £20,000. In regard to Cannon Street, the cost had been correctly stated.

One feature of railways in London was the comparative advantage and cost of underground and overground railways. He could demonstrate that railways above ground were the cheapest, provided the arches were built so that they might be advantageously let; and the Author was quite right in saying, that the arches would pay 5 per cent. on the cost of construction, assuming the cost of railway arches to have been correctly stated. The arches under Cannon Street station would not, in his judgment, realise the rents that had been anticipated, but they would realise sufficient to pay interest on the cost of construction, as those along the line of railway had done already; that was a result which could not be obtained from underground railways.

Mr. J. W. BAZALGETTE thought that the statement that the

arches of railways would pay 5 per cent. upon the outlay was too general and somewhat doubtful. This statement, he believed, could have reference to a few exceptional cases only, for he had found that the bulk of the arches carrying overground Metropolitan railways were not occupied: therefore the argument in favour of Metropolitan overground railways as against underground railways, based upon such an assumption, was hardly satisfactory. Perhaps that opinion could be supported by a more definite statement of the facts, which would tend to justify such a conclusion. The comparison of the advantages and cost of the overground and underground railways within the Metropolis was so important a subject, that such information would have a prominent bearing in the designing of future Metropolitan railways; and certainly without a large return, in the shape of rent, for the arches, to meet the cost of the purchase of property required for overground railways, it would be found that in London those constructed underground were much less costly than those constructed on arches, although the works involved in the former were frequently of a difficult and costly character.

Mr. T. E. HARRISON, Vice-President, thought that in comparing a large span with two small ones, the cost of the columns and the cross-girders ought to be included. In the North of England, where Directors looked not a little to the pounds, shillings, and pence, if it were proposed to make a span of 240 feet the inquiry would at once be made, Was there a necessity for that, and what would be the cost as compared with two spans or even three spans? He had been governed entirely by considerations of cost in the cases in which he had introduced smaller spans; and he knew from experience that roofs varying in span, from 80 feet up to 120 feet, with the columns, cost from £13 to £20 a square as a maximum. He had never found any difficulty in arranging a station with a divided roof. Where Directors looked upon the question of cost as an important element, he, as their Engineer, had been so governed in making his designs.

Mr. PHIPPS observed that the area of foundation-bearing surface was so much greater in the Cannon Street Bridge than in the Charing Cross Bridge, as to give a pressure of 6 tons on the square foot only in the former case, while in the latter it came up to 8 tons.

Mr. HAWKSHAW, Past President, said the difference of construction rendered more columns necessary in the Cannon Street Bridge, as the longitudinal girders required to be supported across the whole breadth of the bridge. At Charing Cross side girders carrying transverse girders were used, and two columns were sufficient. At the Cannon Street Bridge the whole of the main girders ran longitudinally to the bridge. Roofs could be erected at various prices, even when of

the same span; but they might be constructed of such light or undurable materials, that in a short time they would be oxidized and rotted away, as had been the case in some roofs. There was no doubt, also, that the smaller the span the cheaper would be the roof: but he totally dissented from the opinion, that there was no use in getting rid of columns, for he believed that the value of having no columns might far exceed the additional cost of the roof. Take the Tithe Barn station at Liverpool, which was one of the earliest of the large stations he constructed; no columns were used there, but the whole width of the station was roofed over in one span, and as the traffic increased, the lines and platforms were moved and modified, so as to enable treble the amount of traffic to be carried on. That would have been impossible if the roof had been built with columns; and he had no hesitation in saying, that the Company had been repaid the increased cost of making the roof of that station in one span many times over. The question had been fully considered in reference to the Charing Cross and the Cannon Street stations, and he came to the conclusion that intermediate columns ought not to be used. He believed the value of those stations would have been greatly diminished, if they had been divided into bays with columns, for the sake of reducing the price of the roof. He had generally allowed, in addition to the weight of the trusses, 40 lbs. a square foot for the covering and pressure of the wind.

Mr. J. W. BARRY, in reply upon the discussion, said that he entirely concurred in the observations as to the inadvisability of employing columns between the platforms or lines. He thought any one who, after considering the great value of the space enclosed within the walls of those two stations and the enormous cost of the land, looked at the plans, would see at once, from the way in which the platforms were necessarily disposed, the great difficulty there would be in putting columns in positions which would not be objectionable. It was difficult to come to a sound conclusion regarding the prices of roofs, square for square, because the mode of construction, and consequently the cost, varied considerably in different positions and under different circumstances. For instance, in the St. Pancras roof, wooden sash-bars were employed, while at Cannon Street and Charing Cross the sash-bars were of iron. Any one who had been present at the recent fire at Charing Cross station must have owned that the iron sash-bars were preferable; and certainly, in this instance at least, the iron sash-bars might be taken to have well repaid the cost of their adoption. At Charing Cross and Cannon Street stations the position of the streets prevented the employment of any side abutments to sustain the thrust of the roofs, which therefore had to be self-contained. The price of iron was comparatively high at the time the roofs were made; and moreover, as was ex-

pressly stated in the Paper, the cost given was the actual cost of the work as executed, and included every possible item of charge. He thought the proper object of Engineers was to make useful and commodious structures, taking advantage to the utmost of the land at their disposal, which, in situations similar to those under discussion, had been acquired at such great cost. So far as Cannon Street and Charing Cross were concerned, these objects, he thought, had been carried out.

It only remained to say, that when Mr. Ryde estimated that the rent of the arches, capitalised at twenty years' purchase, would pay for the cost of the viaduct, his remarks applied to railways which passed through crowded neighbourhoods, and not to railways like the Greenwich Railway, which for a long distance traversed fields and market gardens.

Mr. GREGORY, President, observed that any engineer who had inspected the Charing Cross Railway and the City Terminus Extension of that line must have been struck with the admirable execution of the works. Undertakings of such magnitude and such character ought to remain on record; and he much wished that engineers generally would emulate Mr. Hawkshaw and his assistants, by giving Papers descriptive of the other Metropolitan lines. Accounts of the works of the underground railways of London, from their Past President, Mr. Fowler, or some of the gentlemen connected with him, would be especially appreciated. Upon such Papers there would be an opportunity of discussing the question suggested by Mr. Ryde, as to the comparative merits and cost of underground and overground railways. A good deal might be said on both sides. It had often been urged, with a certain amount of *primâ facie* good reason, that by making them to a great extent under roads, underground railways were much cheaper; but it was one of those subjects which ought to be exhausted not merely by speculation, but by practical illustration.

He was glad that the Author had adopted the suggestion to give the exact cost, and not the analysed and reduced cost; because all matters which were part and parcel of the cost of a railway ought to be considered by the engineer, particularly looking to the important element of the profit of a work. He had been pleased to hear that the local traffic alone between Charing Cross and Cannon Street produced $2\frac{1}{2}$ per cent. profit on the outlay; but he was afraid, if all the extension railways running into the Metropolis were looked at, they would not be found generally to have been so successful. One of the questions which engineers were bound to consider was the financial results of their various operations.

It had been observed, in reference to a statement as to the cheap cost of the Birmingham roof, that at the time that roof was

made, the price of iron was very low, and it had been stated that the price now was still lower ; but it should be remembered that when the Cannon Street and the Charing Cross stations were built the price of iron was high. The price of ironwork was given in the Paper as £25 a ton when the Cannon Street roof was constructed ; and, in making comparisons of roofs of different styles of construction, the important element of the cost of the raw material ought not to be forgotten.
