PATTERNS AND RELATIONSHIPS WITHIN A CBD (CENTRAL BUSINESS DISTRICT)

THE CENTRAL BUSINESS DISTRICT OF LOUTH – A LINCOLNSHIRE MARKET TOWN

1. Formulate a 'detailed' Hypothesis (statement with reasons) that relates pedestrian densities with distance from the CBD centre (PLVI) Peak Land Value Intersection.

   Pedestrian densities will decrease with distance away from the PLVI. Pedestrian densities will be highest in the Inner Core of the CBD where comparison shops and middle/high order shops and services are found and reduce in the outer core and frame where lower order/convenience services predominate. Higher order services have a larger Range, drawing people from a wider sphere of influence, and are able to pay the higher rents and rates of the core of the CBD.

2. Complete an isoline (isopleth) map of Pedestrian Densities in Louth. Draw lines for 100, 80, 60, 40, 20 pedestrians.

3. Describe and explain what the map shows

Pedestrian densities, based on the 5 minute pedestrian count, are highest (over 100) in the centre of the Inner Core, very close to the PLVI (Peak Land Value Intersection). The isopleths show a gradual decline away from the Inner Core. The pattern, however, varies on different sides of the town. The wide spacing of the isopleths to the east shows a gradual decline in densities along Eastgate. This is the zone of Assimilation, higher order services are taking over here and the PLVI is gradually moving east. To the west the isopleths are very close, indicating a rapid decline in pedestrian numbers over a short distance to below 10. This is the zone of Discard. The land use map indicates that vacant premises are common and CBD functions are being lost.

4. Investigating the relationship between pedestrian densities and distance from the PLVI.
   - Formulate a hypothesis and state this as a Null Hypothesis

'There is no relationship between pedestrian densities and distance from the PLVI of Louth.'
   - Collect the data. A random number table and a map with grid lines is used to generate 12 sites at which pedestrian counts are taken.
   - Measure the distance of each census point from the PLVI in metres using a town centre map (GOAD)
   - Tabulate the data.

Pedestrian densities	Distance from PLVI in metres
120	14
94	23
85	30
72	74
62	38
57	125
50	90
41	68
26	116
20	120
11	150
5	180

- Draw a scattergraph to illustrate the data.
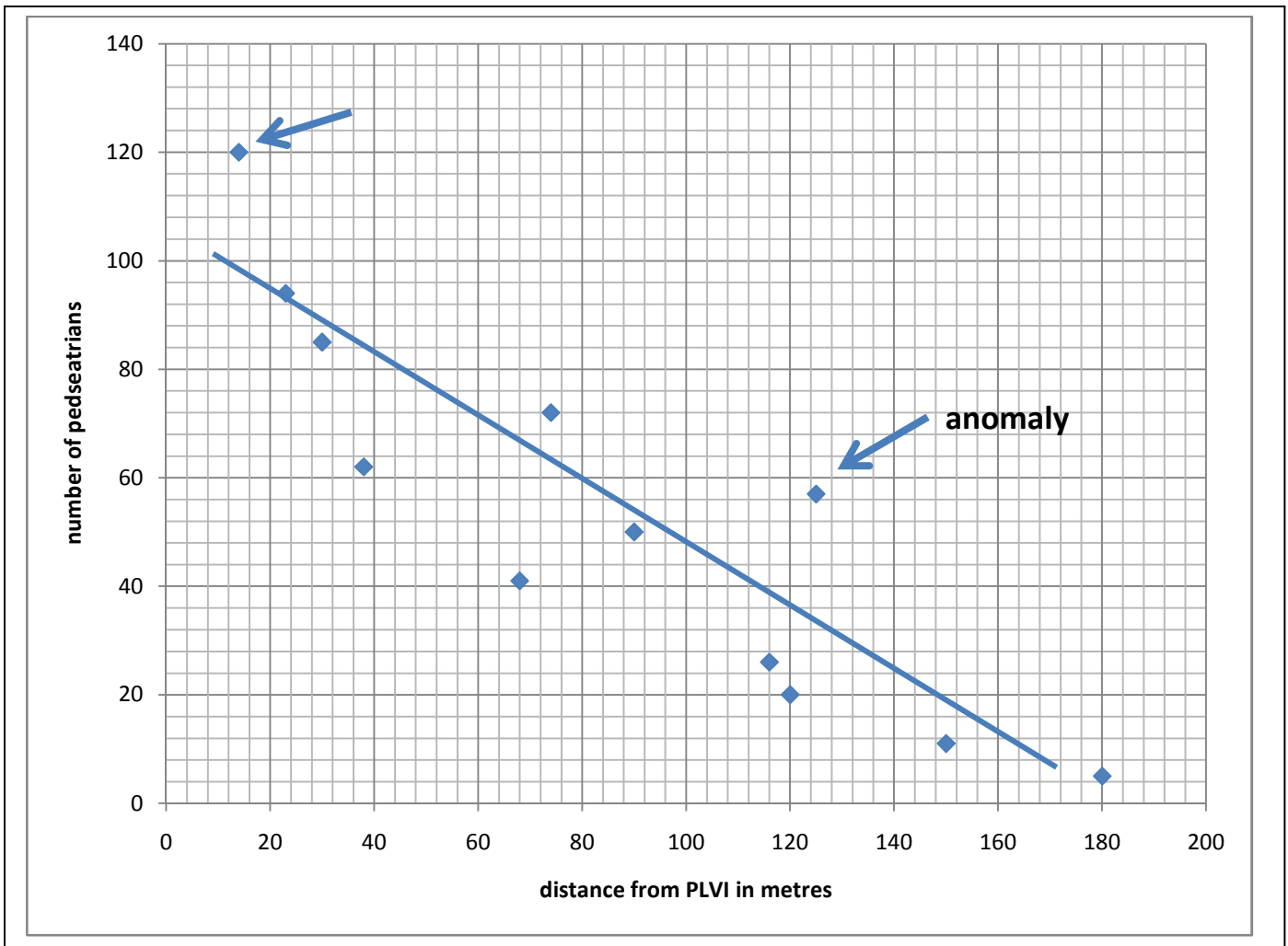
- Discuss what the scattergraph shows

The scattergraph is drawn with distance from the PLVI on the X axis as this is the independent variable and Pedestrian count on the Y axis, the dependent variable. The scattergraph shows a negative relationship/correlation between distance from the PLVI in Louth and pedestrian density. It appears to be a strong relationship as the points lie reasonably close to a best-fit line (the correlation coefficient confirms this). An obvious anomaly is indicated where pedestrian densities are higher than would be expected for a site this far from the PLVI, and a second possible anomaly is indicated very close to the PLVI. An explanation should be sought as this may throw light on other factors that may influence pedestrian densities in a CBD.

- Test the strength of the relationship using Spearman's Rank Correlation Coefficient.

$$(R) = 1 - \frac{6\sum d^2}{n^3 - n}$$

Distance from PLVI metres	rank	Pedestrian numbers	rank	d Difference in ranks	d²
14	12	120	1	11	121
23	11	98	2	9	81
30	10	85	3	7	49
74	7	72	4	3	9
38	9	62	5	4	16
125	3	57	6	-3	9
90	6	50	7	-1	1
68	8	41	8	0	0
116	5	26	9	-4	16
120	4	20	10	-6	36
150	2	11	11	-9	81
180	1	5	12	-11	121
				∑ d²	540

$$(R) = 1 - \frac{6\sum d^2}{n^3 - n}$$

n = number of pairs of data = 12

1 - $\frac{6 \times 540}{12^3 - 12}$

1 - $\frac{3240}{1716}$

1 - 1.888

= - 0.888
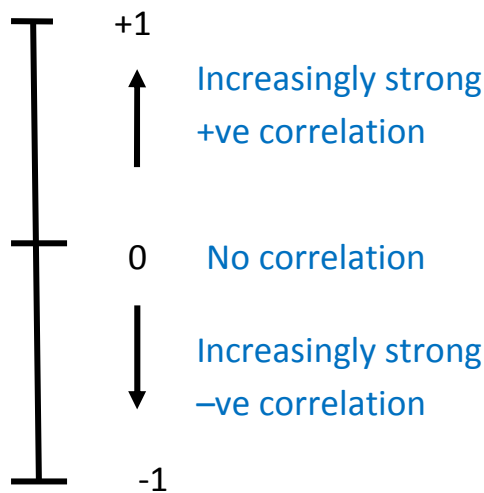
- Discuss the result, its significance and the conclusions you can draw from it.

The Correlation Coefficient is – 0.888, but what does this mean?
It is a negative correlation/relationship, as distance from the PLVI increases pedestrian densities decrease.
But is it significant, can we reject the Null Hypothesis, is it proven than in Louth pedestrian densities decrease away fro the PLVL?
The Spearman's Rank result is always between +1, a perfect positive correlation and -1, a perfect negative correlation, and the closer the result is to zero, the more likely it is that there is no correlation.

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 +1

        Increasingly strong
        +ve correlation



  0     No correlation


        Increasingly strong
        –ve correlation


 -1
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We have -0.888 which looks good, but is it significant.

It must be looked up on significance tables

N (number of pairs	95% significance	99% significance
12	0.506	0.712

The result must be equal to or higher than the value shown in the table to be significant.

The result, -0.888 is significant at the 99% confidence level, therefore the result is highly significant and we can reject the Null Hypothesis and accept the hypothesis that pedestrian densities in Louth decrease with distance from the PLVI.

- Draw a best-fit line on the scattergraph, and use this line to estimate what pedestrian densities should be at 50m and 100m from the PLVI.
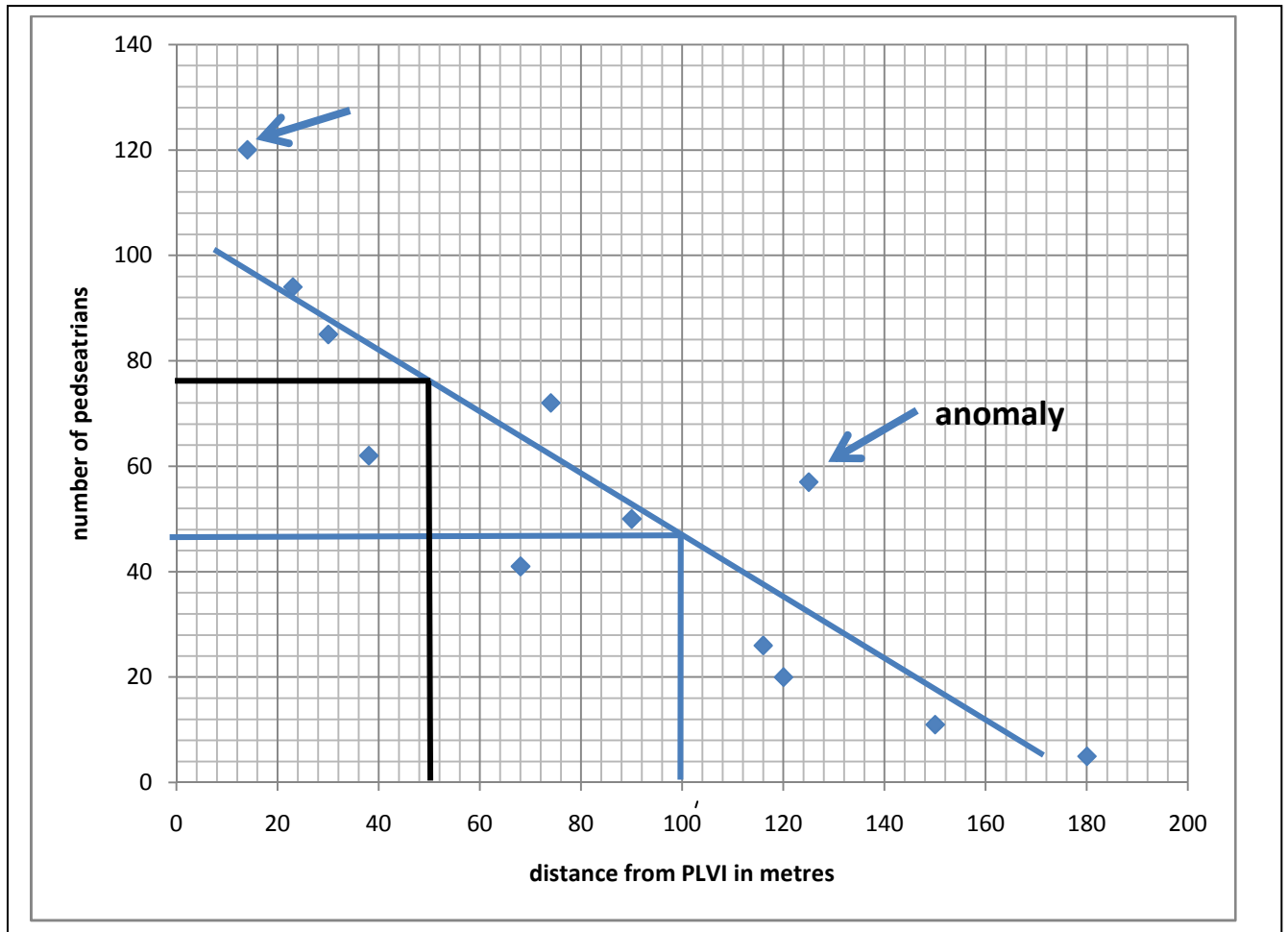
50m from the PLV1   78 pedestrians

100 m from the PLVI   46 pedestrians

- Are there any anomalies? How could they be explained?

The main anomaly has a higher pedestrian density than expected, 57, at 125 m from the PLVI. This site is on Eastgate in the zone of assimilation where higher order services are found well away from the PLVI and these services are a greater draw for shoppers and service users. The second anomaly is closer to the PLVI, but has even more pedestrians than might be expected, 120. This is in the pedestrianised heart of the CBD adjacent to the market place which may account for the very high pedestrian numbers.

- Remember a scattergraph and correlation coefficient only consider two variables. Other factors may be influential in this case in having an affect on pedestrian densities other than distance from the centre of the CBD, the PLVI. What, apart from distance might influence pedestrian densities?

Shop/service types. Convenience or Comparison; high, middle or low order. Comparison or middle/high order services are likely to draw more people from a greater distance.

Location of car parks, greater pedestrian densities would be expected near car parks.

Pedestrianisation. The Market Place is pedestrianised and it is likely that more shoppers/services users will be attracted by the safe environment away from traffic and busy roads.

The location of busy 'through' roads may have a negative impact on pedestrian densities due to safety issues and difficulties in crossing the road.

The location of other services such as cash tills, toilets, banks and markets (outdoor and indoor) may attract more people and so increase pedestrian densities.

- Remember the actual relationship may not be linear.

Although a best-fit line has been added to the scattergraph, it may be that this line does not fully illustrate the relationship shown by the data. Pedestrian densities appear to fall off rapidly near the PLVI and then level off further away. It may be that this is a curvilinear relation ship that might have been better illustrated with a curve rather than a straight line.

LAND VALUES / RATEABLE VALUES WITHIN THE CBD

A. Formulate a 'detailed' hypothesis that relates land values with distance from the PLVI of the CBD.

Land values will decrease with increasing distance away from the PLVI. This is in line with the 'Bid Rent' theory which states that competition for land in the core of the town and the CBD will cause high land/rateable values that can only be afforded by higher order services with a large Range and high Threshold population. A Rate Index calculated for premises within the CBD will decline with increasing distance from the centre.

B. Explain how the rate Index in £ per metre of shop/service frontage is calculated and how data was collected for it (sources and techniques).

A secondary / GIS (Geographical Information System) source was used to obtain rateable values for each of 12 sites chosen at random within the CBD of Louth. The 12 sites were chosen using random number tables to generate references on a grid covering a GOAD town centre map. Rates paid/Rateable Value of each of the businesses at the 12 sites was taken from the on-line Valuations Office Agency (VOA) site. The frontage of the 12 shops/services was measured in metres in the field and a Rate Index calculated by dividing Rateable Value by the frontage to give a value in £'s per metre.

C. Explain why frontage is not the best measure of shop/service size, what other measure would be better?

Rateable value on its own is not suitable since larger premises will obviously pay more and a measure is needed that shows the true 'value' of the land. Frontage is not a perfect measure of shop/service size, since a large shop/service may have a small frontage and vice versa, also land use that may be on upper storeys is ignored. Total area would be better and give a better value for a Rate Index in £ per m², but frontage is easy to measure with a tape in the field and so it is often used. The VOA site rateable value data can also be a year or two out of date.

D. A sample of 12 premises from the CBD of Louth.

Distance from the PLVI is calculated using the town centre GOAD map and its scale.

Rateable value £	Frontage m	Rate Index £/m	Distance from PLVI m
15,250	8.8	1,733	112
30,500	9.0	3,389	90
6,600	9.4	702	60
13,500	10.7	1,262	120
46,750	14.2	3,292	25
28,000	6.1	4,590	22
21,750	6.0	3,625	53
9,100	5.0	1,820	45
7,300	7.2	1,014	170
4,850	3.2	1,516	125
2,125	4.0	531	195
29,000	8.1	3,580	48

E. Draw a scattergraph to show the relationship.
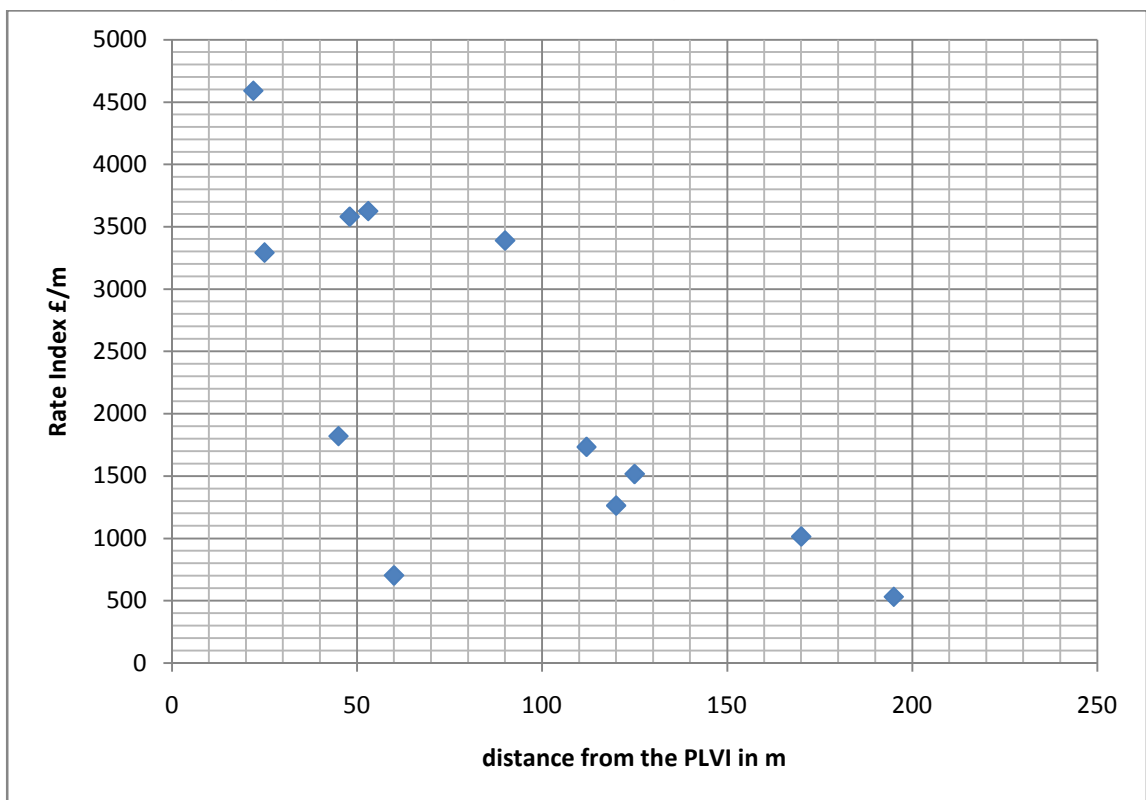
F. Discuss what the scattergraph shows.

The scattergraph shows that the Rate Index and land values decrease away from the centre of the CBD (PLVI) in line with the Bid Rent theory. This is a negative relationship / correlation. The relationship / correlation does not appear to be as strong as that for distance and pedestrian densities as there is a wider spread of points and more probable anomalies.

G. Test the strength of the relationship using Spearman's Rank Correlation Coefficient.

Distance from PLVI metres	rank	Rate Index £/m	rank	d Difference in ranks	d²
112	5	1733	7	-2	4
90	6	3889	2	4	16
60	7	702	11	-4	16
120	4	1262	9	-5	25
25	11	3290	5	6	36
22	12	4590	1	11	121
53	8	3625	3	5	25
45	10	1820	6	4	16
170	2	1014	10	-8	64
125	3	1516	8	-5	25
195	1	531	12	-11	121
48	9	3580	4	5	25
				Σ d²	494

$$(R) = 1 - \frac{6 \sum d^2}{n^3 - n}$$

n = number of pairs of data = 12

1 - $\dfrac{6 \times 492}{12^3 - 12}$

1 - $\dfrac{2964}{1716}$

1 - 1.727

= **- 0.727**

H. Discuss the result its significance and the conclusion

The result of -0.727 is a negative correlation as was expected, showing that the Rate Index, a measure of land value decreases away from the centre of the CBD in Louth. Comparing the result to the significance table for 12 pairs of data

N (number of pairs	95% significance	99% significance
12	0.506	0.712

It is just significant at the 99% confidence/ significance level so we can reject the Null Hypothesis that there is no relationship between rateable/land values and distance from the centre of the CBD and accept that we have proved the hypothesis that in Louth there is a strong relationship, although it is not as strong as the relationship between distance and pedestrian densities.

I. Now draw a best-fit line on the scattergraph and highlight any anomalies.
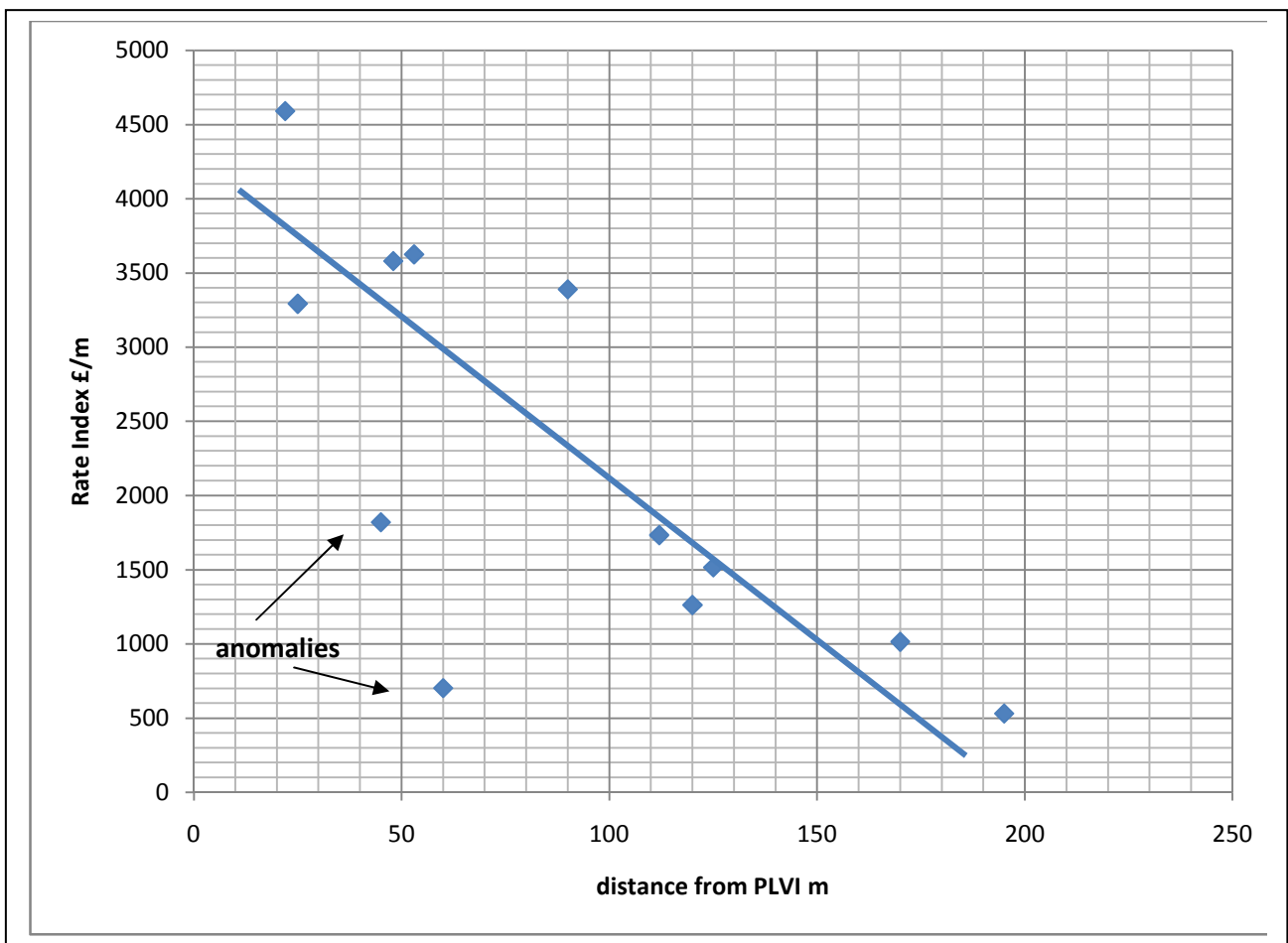
J. Discuss the graph and the anomalies

The best-fit line shows the correlation very clearly, although the points are not as close to the line as they were for the graph for distance against pedestrian densities. This means that there are more anomalies. Two clear anomalies are seen at 45m and 60 m form the centre for the CBD. They have Rate Indices that are far lower than they should be this close to the centre. Both are found to the west of the CBD in the Zone of Discard, where CBD functions are being lost, empty premises are more prevalent and pedestrian densities are lower. The land here is seen as less valuable and shops/services cannot afford high rents.

THE CBD CORE – FRAME MODEL