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THE ROLE OF LAND  
READJUSTMENT IN  
REBUILDING THE CITY  
CENTRE OF ROTTERDAM  
AFTER THE SECOND  
WORLD WAR

MA Architecture and Cities Dissertation  
8/29/2012 | Soheil Fattahieh

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# THE ROLE OF LAND READJUSTMENT IN REBUILDING THE CITY CENTRE OF ROTTERDAM AFTER THE SECOND WORLD WAR

## SECTION 1: INTRODUCTION

The German military destroyed Rotterdam with bombs in 14 May 1940. As a result, approximately 24,000<sup>1</sup> houses were totally demolished across Rotterdam (Cos, 2006, p6), although this disaster mainly effected the city centre. The land mass in the city centre of Rotterdam became an open space (Diem, 1967, p12)<sup>2</sup>; 11,000 building structures were completely destroyed totalling 258 hectares (Needham, 2002, p11).<sup>3</sup> With this disaster Dutch architects and planners got a unique opportunity to redesign and regenerate the urban space and brought it a new concept of urban quality to the city centre. After the regeneration in late fifties-early sixties the city became the darling of Europe and a well-known city globally.

The centre of Rotterdam now has a new urban quality with new constructions and fewer mediaeval European characteristics than other similar cities. For this reason the city generated its own tourism. This

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<sup>1</sup> In a different source about World War Two and Rotterdam, the figure shows the number of demolished houses is 25,500 houses. In this research both numbers are used to present different events. According to the Museum of OORLOGS VERZETS MUSEUM ROTTERDAM the number of destroyed buildings rose to 25,500.

<sup>2</sup> Aubrey Diem is Professor of Geography at the Department of Environmental Studies at University of Waterloo in Canada.

<sup>3</sup> Dr. Barrie Needham is Professor of Spatial Planning of the University Nijmegen in the Netherlands.

great achievement could not have done without the tragic German bombardment of the city. Rem Koolhaas has described this contradictory situation as 'no crater, no city' (Koolhaas, 1995, p552).

Only a few years after 1940, the city centre was rebuilt dramatically with a special method of planning called Land Readjustment (Needham, 2002, p11). This method not only changed the old medieval parcellation of the city, it also incorporated new roads, cycling roads, green spaces court yards and parks into the city centre. Traditionally Land Readjustment forces a group of land proprietors to develop or redevelop land and change the irregular plots of agricultural land into urban plots (Sorensen, 1999a, p2333). The city centre was rebuilt using this compulsory Land Readjustment method (Needham, 2002, p11). However, in this case Land Readjustment was used differently. It was used entirely in an urban area to regenerate the city centre not for rural purposes.

In the twentieth and twenty first century Land Readjustment has had great success in many countries, such as Germany, Japan, the Netherland, France, Israel, Korea etc. and limited success in the USA. In the USA Land Readjustment was only used in Florida, Hawaii and California (Home, 2007a, p4)<sup>4</sup>.

In the literature, it is possible to observe that country's claim to be the first nation which has used this technique. For instance, according to Hamlin and Lyons, the USA had previously used Land Readjustment in 1791, and George Washington had already employed it to implement L'Enfant's

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<sup>4</sup> Rob Home is Professor of Land Management at Anglia Ruskin University in the UK.

design for Washington, D.C (Hamlin, Lyons, 1996, p44). However, according to MÜLLER-JÖKEL, Franz Adickes who was a lord Mayor of Frankfurt had formerly used Land Readjustment more than 100 years ago and put forward the relevant law about Land readjustment in Germany (MÜLLER-JÖKEL, 2004, p1)<sup>5</sup>.

This case study on Rotterdam focuses particularly on this use of Land Readjustment and explains the process of regeneration of the city centre. Rotterdam has a significant historical meaning in architectural design. The practical used of Land Readjustment in Rotterdam presents it as a Utopian city in Europe. The urban quality of the city centre (in particular the Coolensingel Boulevard) and its environmental elements can be introduced as an interesting case study city. This research does not show the progressive development of urban design in Rotterdam, but it presents the effects of the use of Land Readjustment for reconstructing Rotterdam seven decades later in the twenty first century.

This research has six sections. The first section will focus on the history of Rotterdam and will present its development in a time line. The second section will lay emphasis on the modern movement of architecture in Rotterdam before World War Two and will focus on some landmarks that existed and survived in Rotterdam today. The third section will focus on the scale of the catastrophe in the city centre of Rotterdam during World War Two and the regeneration process after the bombardment. The forth section will analyse the method used in the city centre of Rotterdam, called Land Readjustment, in detail. This section introduces the technical

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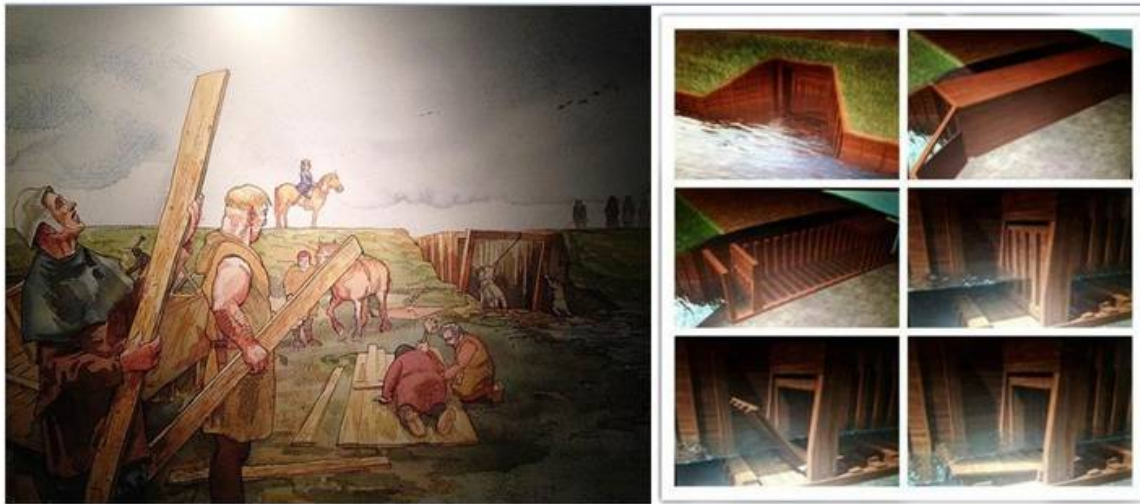
<sup>5</sup> Rainer Müller-Jökel is Lecturer at the Frankfurt University of Applied Sciences

issues surrounding Land Readjustment and how it works in urban design. The fifth section will examine the urban quality and condition of the city centre after World War Two. The sixth section will focus on the regeneration of Coolsingel Boulevard in the city centre before and after the regeneration of the city centre up to the twenty first century.

## **SECTION 2: HISTORY OF ROTTERDAM AND ITS DESTRUCTION IN WORLD WAR TWO**

### **SECTION 2.1: HISTORY OF ROTTERDAM**

Rotterdam is the second largest city in the Netherlands and it is located near to the North Sea where three rivers come together: the Rotte, the Meuse and the Rhine. Basically, the creation of a dam in the river Rotte gave the name (Rotte[r]Dam) (URBED and Van Hoak, 2008, p11). The structure of this dam was made of wood which created a significant urban design for Rotterdam. The dam was furnished with locks and these locks had two specific functions. The first one was to protect from flooding and the overflow of water. The second one was to drain excess water at low tide (*Museum Rotterdam 'Het Schielandshuis'*, 2012, p1) (please refer to figure 1).



Picture A

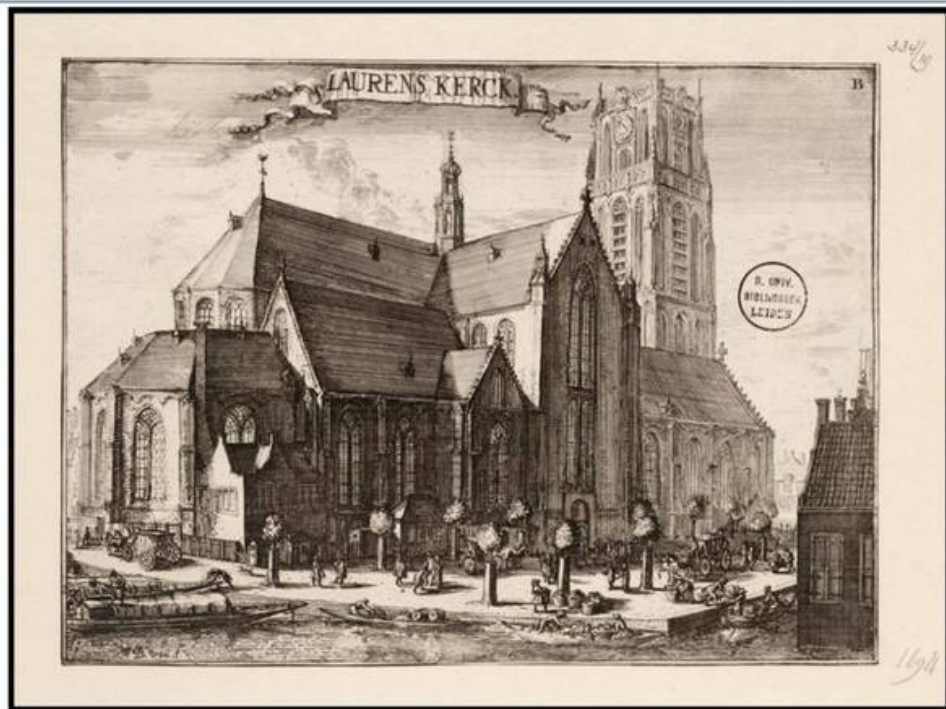
Picture B

Figure 1: picture A (top left) shows the painting related to process of building dams in Rotterdam around 1300 (Museum Rotterdam '*Het Schielandshuis*', 2012) (photograph by author). Picture B (top right) shows the reaction of wooden locks during flooding (picture captured by author from video clip related to function of dam in about 1300) (Museum Rotterdam '*Het Schielandshuis*', 2012).

Many events in history were important for Rotterdam. For instance, approximately before 1164 Rotterdam was a fishing village called Rotta. In 1164 floods affected the village and it was completely swept away. This catastrophe happened because of a lack of dikes. After 1250 the village built dikes and it started to flourish. In June 1340 Willem IV granted city status to this village. The city grew fast and in the fourteenth century the city developed its port. In the fifteenth century Laurenskerk (the medieval church in the city centre), built with brick material at that time, was the only structure in the city centre using bricks (figure 2). In the sixteenth century the population of Rotterdam grew to 20,000 people and the centre of the city created a new extension to the port. By around 1600



Rotterdam had a large port and the advantageous European location of Rotterdam enabled it to trade with different countries from all over the world. For example, at that time importing exotic goods such as pepper, nutmeg and clove from Indonesia was undertaken through Rotterdam to Europe. This trade with Indonesia continued until 1602<sup>6</sup> (figure 3). As a direct consequence of the successful trading of the Rotterdam port and the location of the city, its population grew to 50,000 at the end of seventeenth century (Cos, 2006, p6 & URBED and Van Hoak,2008, p11 & Spiessens, 2010,p18).



<sup>6</sup> From 1600 to 1602 all of the international trade in Rotterdam was in the hands of one company called 'Verenigde Oost-Indische Compagnie (VOC) (Spiessens, 2010, p18).

Figure 2: shows a painting by 'Vouw, Johannes de (-1707)' it shows the Laurenskerk church in 1694 (Photograph by Topography of the Netherlands of Bijzondere Collecties Leiden, 2003a).

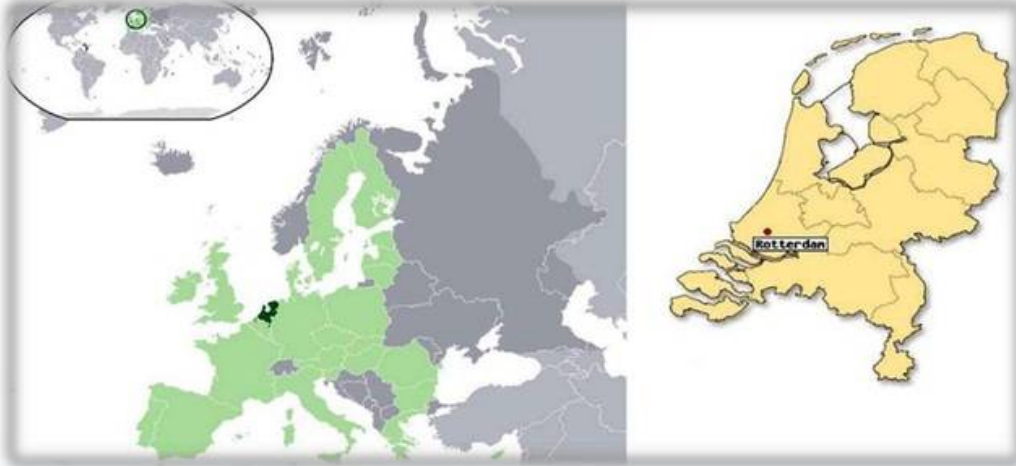


Figure 3: the global map shows the key location of the Netherland in the north-west part of Europe. Rotterdam is located in the west part of the Netherlands (Photograph by Aarts, Daamen, Huijs and Vries, 2012).

The development of a new channel called 'Nieuwe Waterwage' in 1872 created a new water way to connect Rotterdam directly to the North Sea. As a result the city and the port grew gradually, and with the great location of the city a lot of German and British immigrants arrived in Rotterdam. Consequently, the number of people grew from 210,00 to 515,000 between 1890 and 1920, and in this period the municipality invested eighty million guilders into the design and construction of the port. This investment brought 1,800 hectares into the port area (the port area in 1880 was only 200 hectares) (figures 4&5) (GO and Govers, 2011, p43 & Diem, 1967, p9 & Steenbeek, 1973,p9 & Loyen, Buyst and Devos, 2003, p225 ). After World War Two and the destruction of the city,

Rotterdam rebuilt the destroyed docks and modernized the port at the end of December 1949. As a result Rotterdam received a large number of incoming ships. The regeneration of the city and the port in 1962 changed Rotterdam for good. One hundred years ago Rotterdam was not significant from the international point of view and today it is one of the largest ports in the world (Cos, 2006, p6 & Diem, 1967, p9).

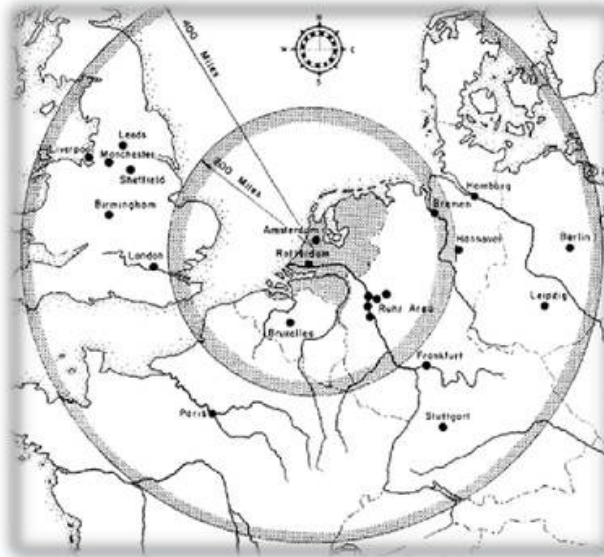


Figure 4: shows the central position of Rotterdam in connection to other European countries within a 400 mile radius (Diem, 1967) (map by H.J.stolle in 1965).

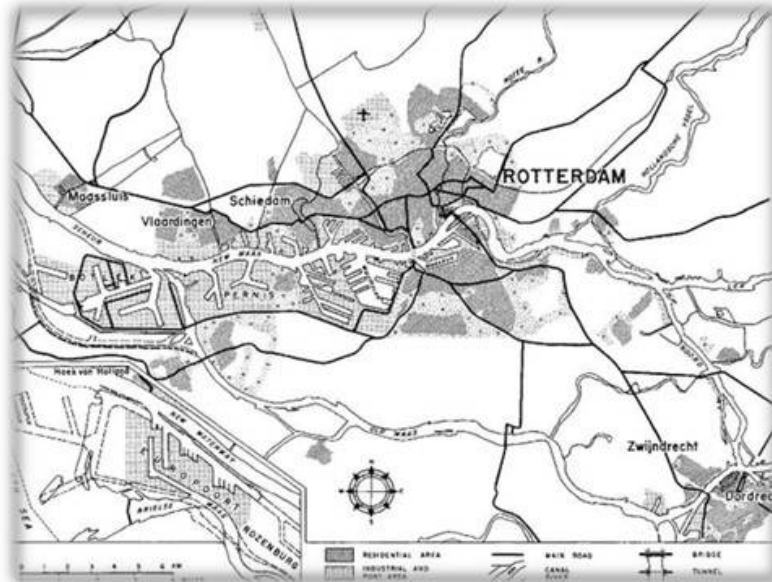


Figure 5: shows Rotterdam and the vicinity area in to contrast to the North Sea and Rotterdam (Diem, 1967) (map by H.J.stolle in 1965).

### SECTION 3: ROTTERDAM BEFORE 1940

The modern movement of architecture started at the beginning of the twentieth century in Rotterdam and this movement can be analysed and recognized from many modern buildings constructions before World War Two. The purpose of this section is to show Rotterdam before the war started and to compare it to the modern architecture created in the city centre after the war. The literature shows that Dutch architects had a great opportunity to create modern structures and a modern city in Rotterdam. However, modernism in Rotterdam did not start after the war, it was already developed in the city. The war facilitated the opportunity for modern architecture to develop and dominate in the design of urban spaces.

Before 1940 the city was a centre of culture and offered an exciting lifestyle. The picturesque city centre included a large library with numerous art treasures and old structures which attracted tourists for all around the world. However, the development of architecture before 1940 brought the modern movement of architecture into the urban design of Rotterdam. For example, architect Willem Molenbroek built an 11-storey skyscraper in the city centre called (*Witte Huis*) 'white house'. Luckily the building survived World War Two. This structure is today the oldest skyscraper in Europe and has become a landmark of Rotterdam (Aarts, Daamen, Huijs and Vries, 2012, p14 & Binder, 2006, p8) (please refer to photographs 6, 7, 8, and 9).



Figure 6: Façade plan of the (*Witte Huis*) 'white house' in Rotterdam. This plan shows the north view (right of picture), east view (middle of picture) and south view (left of picture) (Photograph by Damen, Camp, Devolder, 1991).

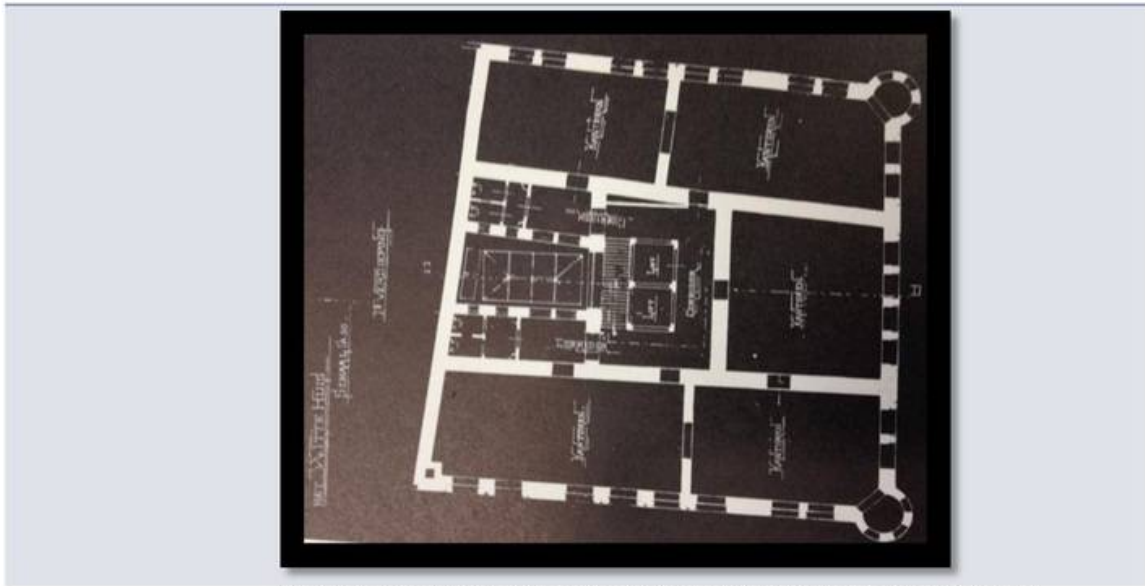


Figure 7: architecture plan of the (*Witte Huis*) 'white house' in Rotterdam (Photograph by Damen, Camp, Devolder, 1991).



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Figure 8: Bird's eye view of the city centre before World War Two, the white house can be seen (at the right of this photo). In terms of design and height this structure has a contrast with others buildings in the surrounding area (Photograph by Damen, Camp, Devolder, 1991).

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Figure 9: shows the contrast between Willemsbrug bridge (red bridge in the left of photo) and the white house in the twenty first century. The fascinating view and the open space with the green line of trees create a unique social place for people to sit in restaurants in the surrounding area nearby (photograph by author).

In the 1929 the city was well-known as "the most American city on the continent". This is because it had examples of good design and eye-catching structures at that time. For instance, Dutch architect Jacobus Johannes Pieter Oud(J.J.P) (1890-1963) designed the modern structures

of the Café De Unie, the Keifhoek Workers' Housing Development, the Tusschendijken Blocks, the proposal for council housing in Rotterdam, etc. (please refer to pictures A, B in figure 10 and figure11). Another Dutch architect Van der Vlugt Oud (1894-1936) brought the same concept of modern structure into the city and designed the Van Nelle Factory (1925-1931) in Rotterdam. These examples represent some modern structures that were already landmarks in the city before World War Two. At that time Dutch people ventured to offer space for modern-looking structures. The trend in other cities was to openly rejected modernism, according to the literature in other cities people did not dare accept modern looking structures (Mc Carthy, 1999, p294 & Kloosterman and Stegmeijer, 2005, p217 & Steenbeek, 1973,p9, Netherlands Architecture Institute(NAI), 2011,p25)<sup>7</sup>.



Picture A

Picture B

Figure 10: picture A (top left) shows the Keifhoek Workers' Housing (1926-1930). (Photograph by Topography of the Netherlands of Bijzondere Collecties Leiden,

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<sup>7</sup> John Mc Carthy is lecturer at the School of Town and Regional Planning at the University of Dundee



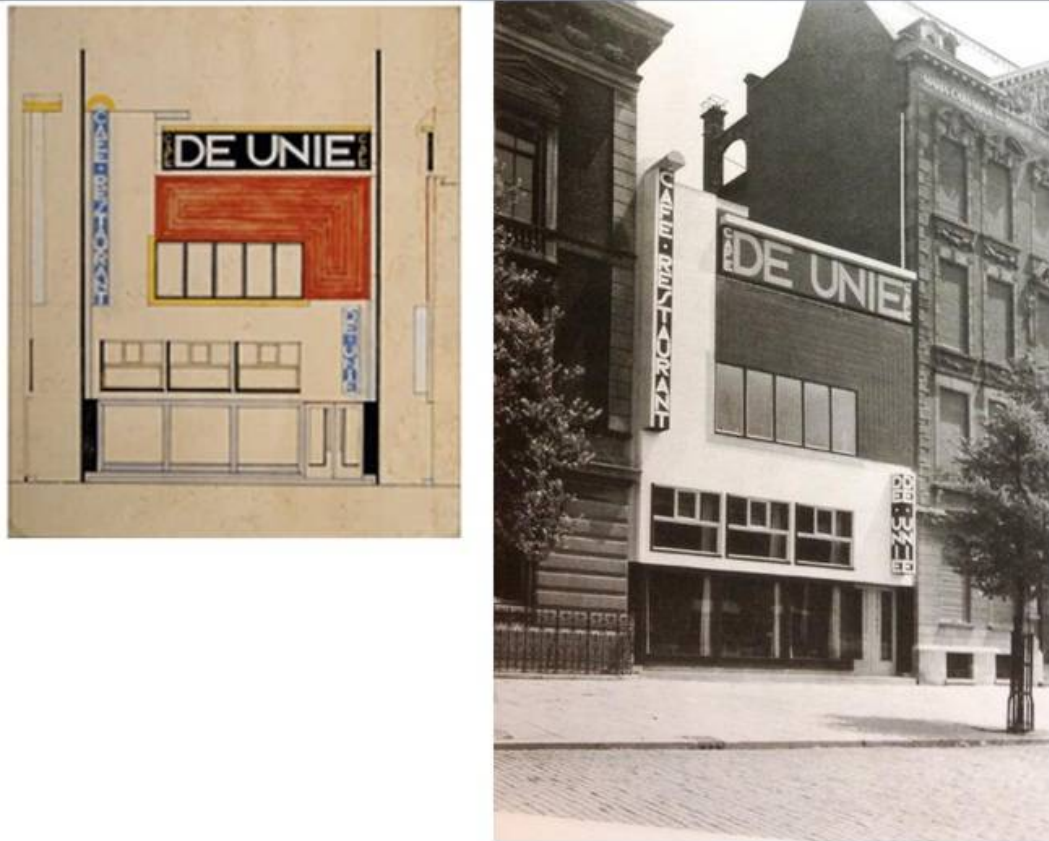
2003b) Picture B (top right) shows the interior courtyard of Tusschendijken blocks (1920-1923). (Photograph by Topography of the Netherlands of Bijzondere Collecties Leiden, 2003c)



Figure 11: bird's eye view of the proposal for council housing in Blijdorp in Rotterdam. J.J.P. Oud designed modern rational groundwork with the massive block of buildings. The architect designed the closed urban blocks with the open row layout. The orientation of these buildings is in relation to the sun. In his work he created a shield from passing traffic and a green internal garden for urban design during 1931-1932 (Netherlands Architecture Institute(NAI), 2011,p25). This design work is important because it shows that Dutch architects before World War Two tried to create a modern and sustainable urban design with creation of green internal gardens for interdicted sustainable design for city (proposal painting of J.J.P. Oud in museum of Netherlands Architecture Institute(NAI)). (Photograph by author, 2012).

### SECTION 3.1: CAFÉ DE UNIE

Architect J.J.P.Oud designed one of the most remarkable structures in the city centre during the 1920s. In terms of design this structure was significant to the present modern city centre. Originally it was built in the Coolsingel Boulevard with unique shapes and colourful façades, a feature of the modern cafés in Rotterdam. At that time this modern café made was in sharp contrast to the adjacent buildings in the surrounding area such as the '*Erasmiaans Gymnasium*' grammar school and *Maria Catharina van Doorn's vrouwengesticht van Weldadigheid*, a charity organization (please refer to figure 12). This café was completely demolished by the German bombardment in 1940. However, after World War Two there is no trace remaining of this remarkable structure in this area. A replica of the façade of the original building was built in Mauritsweg Street in 1986 (Van der Schoor, 2010, p 240) (figures 13,14).



Picture A

Picture B

Figure 12: picture A (top left) shows the original drawing of the façade view of the Café De Unie (1924) made with Indian ink, water colour and gouache on paper (photograph by Philippe Migeat) (photograph by Centre Pompidou, 2010). Picture B (top right) Café De Unie located in the Coolingsel Boulevard with a striking façade located between Maria Catharina van doorns vrouwengesticht van weldadigheid (right side of Café De Unie) and Erasmiaans Gymnasium (left side of Café De Unie) (photograph by E.M.van Ojen,1925) (Van der Schoor, 2010, p 240).



Figure13: new Café De Unie built at 1986 which is today located in Mauritsweg Street in Rotterdam (photograph by author, 2012).



Figure14: current location of Café De Unie on Google map (Photograph by author).

#### **SECTION 4: ROTTERDAM IN 1940**

The year of 1940 was a significant point in Rotterdam's history. This city was to celebrate its sixth centenary and a great celebration was planned for Rotterdam (Steenbeek, 1973, p9). The German military started to attack on 10<sup>th</sup> May 1940. They captured the strategic bridge called 'Maasburggen' (bridge for crossing the river Meuse) and the Dutch military couldn't recapture it. Firing between them continued for five days (figure 15) (Gemeentearchief and Rotterdam, 2008, p1). On 14<sup>th</sup> May 1940 the city centre was heavily bombed and this area was completely wiped out. The war between the Dutch and the Germans changed the urban design of the city centre of Rotterdam. This bombardment also demolished several villages and towns in the surrounding area, such as, Rhenen and Wageningen (figures 16,17) (Bullock and Verpoest, 2011, p192).



Figure 15: the black dots show the bombardment of the German army on the city centre (Photograph by Gemeentearchief Rotterdam, 2008).



Figure 16: the white areas show the empty space of land after the bombardment and the scale of the catastrophe for the city (Photograph by Gemeentearchief Rotterdam, 2008).

The bombardment killed 900 people and made a 77,000 people homeless - in total 24,000 houses were destroyed in Rotterdam (Cos, 2006, p6) (table1). The day after the bombardment the huge scale of the debris and demolished structures made the German military order the mayor of Rotterdam (P.J. Oud) to remove the rubbish out of the city centre. The reason for this order was to enable the German troops to move freely about the city centre (Spiessens, 2010, p19). Over 20,000 volunteers and people who were homeless joined in to help and clean the streets of rubbish (Oorlogs Verzets Museum Rotterdam, 2012, p9). In the city centre the majority of constructions, including historical buildings, were damaged. The municipality created a 'building policy' to list all of the

existing structures in the city centre and to survey the remaining architectural heritage. This list recorded 114 buildings that could be saved in the city centre. However, the mayor of Rotterdam decided to remove the heavily damaged constructions and not to keep them, but only to keep some of the historic structures in the city such as the Delfse Poort, the St. Laurenskerk and the Schielandshuis (please see figures 18,19 and 20) (Spiessens, 2010, p19).

The main reason behind the removal of the remaining historical constructions was to facilitate the reconstruction as many old constructions presented obstacles for regeneration. A handful of buildings were preserved and removing rubbish and old damaged structures from the city centre created an empty space at the heart of the city centre. This physical emptiness gave an opportunity to the municipality to apply a new planning system into the city. However this was not good enough for practical regeneration processes. The old cadastral registration of ownership became obsolete and had to be changed to speed up regeneration. Therefore, the whole city centre was expropriated by the municipality on 24<sup>th</sup> of May 1940. As a consequence the regeneration process was facilitated without administrative delays (Spiessens, 2010, p19) (figures 21, 22).



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Figure17: panoramic photograph shows the high density of the city centre prior to the bombardment. The picture was fragmented and reassembled from YouTube documentary 'Trailer film concert Verwoeste Stad'(<http://www.youtube.com/user/Brandgrens?feature=plcp>) (Rotterdam municipality film archive, 2011).

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Figure18: the destruction caused by the bombardment of the city centre during World War Two. The picture was fragmented and reassembled from YouTube documentary 'Trailer film concert Verwoeste Stad'(<http://www.youtube.com/user/Brandgrens?feature=plcp>) (Rotterdam municipality film archive, 2011).





and Cities (2011/2012)

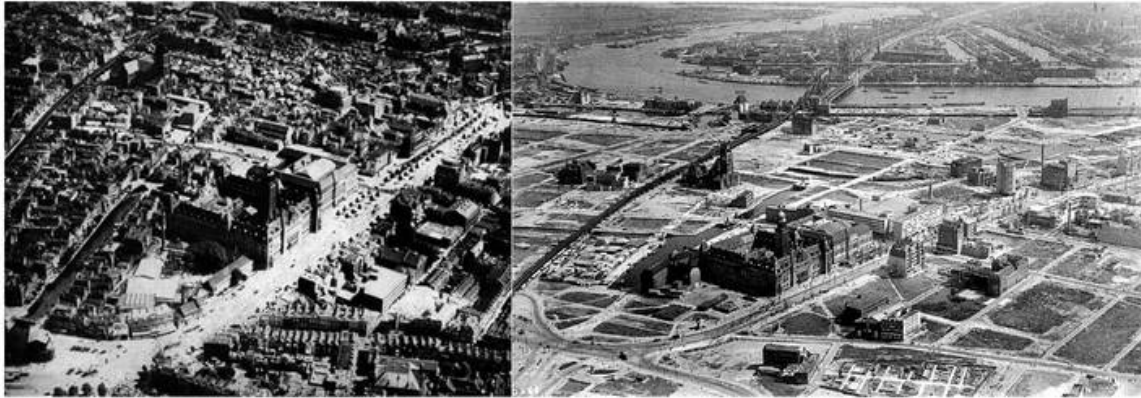
Figure 19: shows the obliteration of constructions by German bombs in 1940 in the city centre. Few structures survived and Laurenskerk church is one such medieval structure which is located in the city centre. It was heavily damaged during World War Two (Photograph by Kamman, Jan, 1940-1950) (Topography of the Netherlands of Bijzondere Collecties Leiden. 2003d).



Figure 20: the Schielandshuis (down right of the picture) after bombardment.

(Photograph by

<http://www.flickr.com/photos/66617569@N04/6064360211/in/photostream/lightbox/>, na).



Picture A

PictureB

Figure 21: picture A (left top) shows the south east part of the city centre of Rotterdam. It shows the main boulevard called Coolingsingel and the stadhuis<sup>8</sup> (city hall) (main building in the picture) and the post office<sup>9</sup> (beside the main building). Picture B (right top) shows the city centre after the 1940 bombardment and some remaining constructions such as city hall and the post office (Photograph by Diem, 1967).

| 14-may-1940  | 18-may-1940                                     | 1945   | 1950s   | 1962   |
|--|---|--|---|--|
| <p>900 dead</p> <p>77,000 homeless</p> <p>24,000 houses were totally destroyed</p> <p>2,400 shop</p> <p>2,000 workshop</p> <p><b>1,450 offices</b></p> <p><b>566 cafes</b></p> <p><b>69 school</b></p> | <p>The determination to reconstruct is made</p> | <p>The regeneration of the ports and docks and industrial acre receives priority</p> | <p>Regeneration of the city centre ; after World War Two housing out suburban areas</p> | <p>Rotterdam becomes the largest port in the globe</p> |

<sup>8</sup> Stadhuis (city hall) was built in 1920 and it survived the bombardment (Weevers, Agudo and Moser, 2007, p100).

<sup>9</sup> The post office was built in 1923 and survived the bombardment (Weevers, Agudo and Moser, 2007, p100).

|                                   |  |  |  |  |
|-----------------------------------|--|--|--|--|
| <b>buildings</b>                  |  |  |  |  |
| <b>24 churches</b>                |  |  |  |  |
| <b>13 hospital</b>                |  |  |  |  |
| <b>12 cinemas</b>                 |  |  |  |  |
| <b>4 newspaper<br/>businesses</b> |  |  |  |  |
| <b>2 theatres</b>                 |  |  |  |  |
| <b>88 other<br/>buildings</b>     |  |  |  |  |

Table 1: Time line of post war reconstruction between 1940 and 1962 (Cos, 2006, p6).



Figure 22: shows bird's eye view of the city centre after 1940. The huge scale of the catastrophe created emptiness and an open space without construction in the inner of city after World War Two. (Photograph by information centre Weena 705 (Groothandelsgebouw), na.)<sup>10</sup>

#### SECTION 4.1: ROTTERDAM FROM 1940 TO 1946

Immediately after the German bombardment in 1940 the process of reconstruction of the city centre started. The Dutch state compulsorily purchased all property in the city centre and created a new planning system for the city. For this reason, the process of making a new plan was facilitated (Van der Wal, 1997, p59). The process of planning was run by the Department for the Execution of the Reconstruction of Rotterdam (*'Dienst voor de Uitvoering van de Wederopbouw van Rotterdam'*). Four days after 14 May 1940 Dr. W.G.Witteveen a city architect and urban planner, was instructed by the municipality to create a plan of urban design for the city centre and the first drawing of the plan was completed in December 1941 (Diem, 1967, p12). At that time the new planning system received a lot of criticism. First of all, the concept of regeneration and new planning was based on one entity with newly developed neighbourhood for the city. However, the traditional Dutch concept of 'district' was based on an idea of organic neighbourhoods called '*wijkgedachte*' which means 'neighbourhood community thought'. This brought the strong criticisms against Dr. W.G.Witteveen's rational urban planning (Van Bronswijk, Doevendans, Smeets and Verbeke, 2002, p 40& Van der Wal, 1997, p59). Secondly, implementation of the plan in

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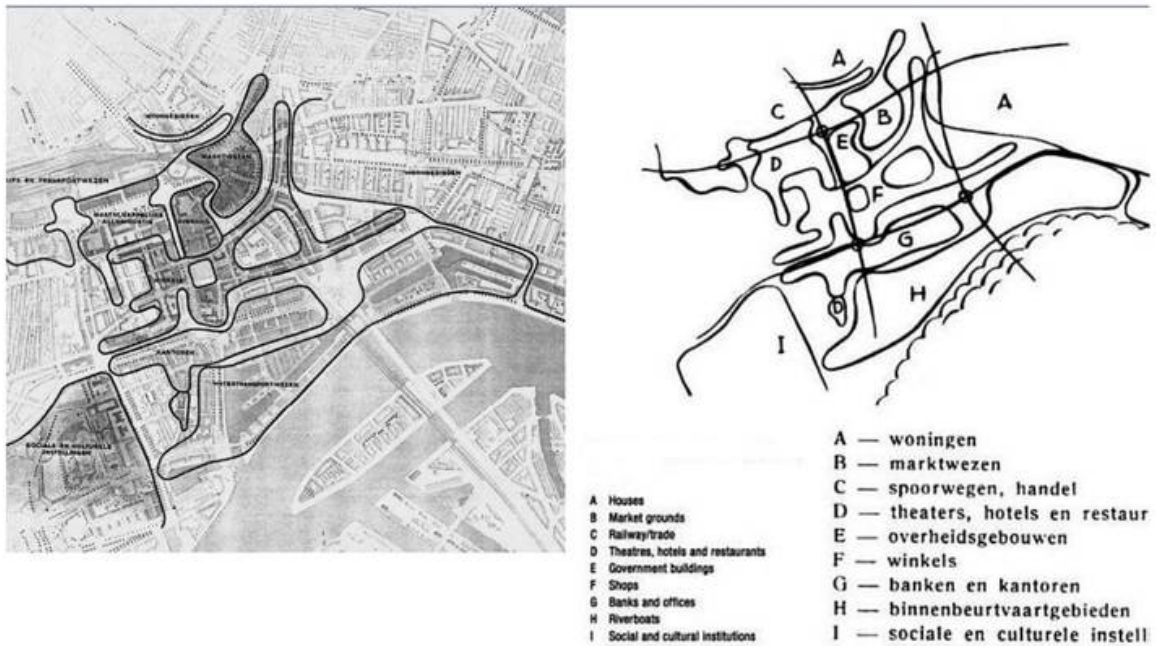
<sup>10</sup> Photograph received from 'Rotterdam world port world city' company by email.

1941 was hard to achieve owing to the fact that there was a deficit of construction materials, labour and fuel as they were military priorities. Reconstruction therefore brought challenging problems for the municipality when applying the plan (McCarthy, 1998, p339).

Finally, the three-dimensional aspects of the new plan brought about controversy among those who were uncompromising about a modern metropolis. In 1944, facing opposition Witteveen left the plan permanently. However, Van Traa who was a secretary of Witteveen continued the plan with the same concept. Van Traa modified the plan and made it more accurate conceptually but without been third dimensional in 1945. This plan not only solved most of the problems, it also drew positive support from the city council. Nevertheless, the new scheme was too schematic to apply on land and it needed more attention to detail. Van Traa and S.J. Van Embden, students and employees of Granpré Molière<sup>11</sup>, developed another plan one year later in May 1946. The plan was called the 'Basic plan' of the city centre. The main aim of the 'basic plan' was to change the urban quality and to optimize the use of the 640 hectare of land in the city centre. Although many other European cities suffered similar destruction during the war, only Rotterdam succeeded in regenerating its city centre with a rational and modern plan without any connection to the past ( Van der Wal, 1997,p59 & Mc Carthy, 1999, p295 & Diem, 1967,p12) (figures 23, 24).

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<sup>11</sup> Granpré Molière(1883-1972) was a Dutch architect and professor at the Delft University of Technology.



Picture A

Picture B

Figure 23: picture A (top left) concept of basic plan of regeneration of city centre after World War Two in 1946 (photograph by Mc Carthy, 1999). Picture B (top right) site plan for functional zoning of the city centre in 1953 (Stichting Rotterdam-Maaskant, 2002, p46)<sup>12</sup>.

The basic plan was based on a design that divided the city into manageable parts. It was presented as a "survey" or a (preliminary research) of the existing city centre (Van der Wal, 1997, p59).

<sup>12</sup> The team of architectural historian based in Rotterdam.

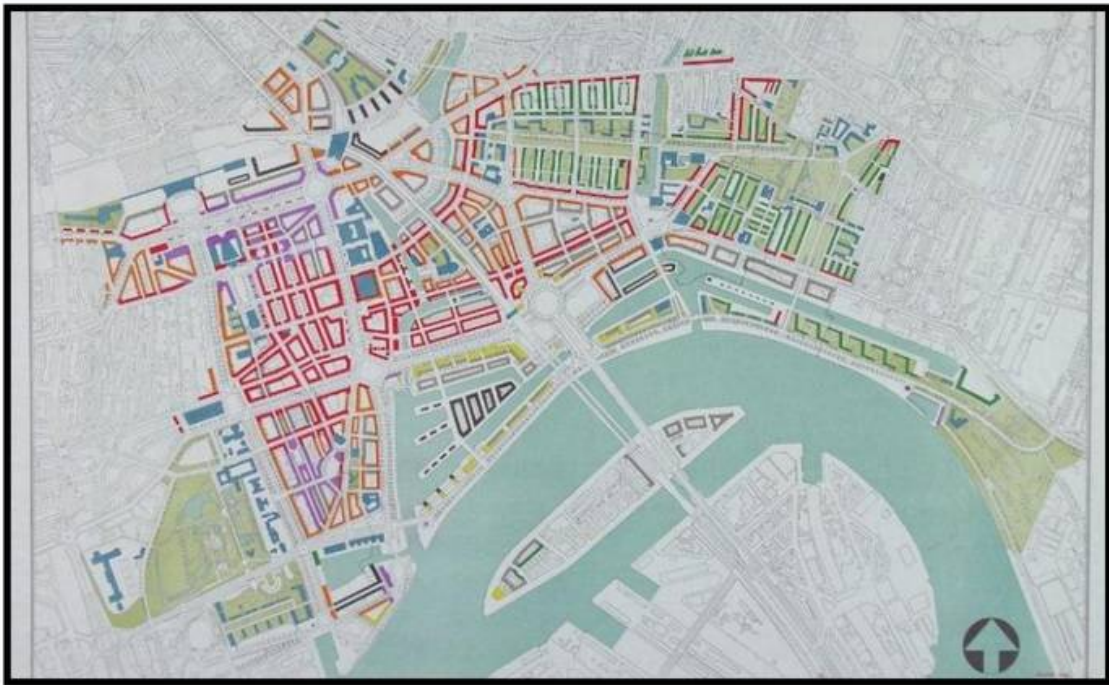


Figure24: the basic plan of city centre designed by C.van Traa (Photograph by Spiessens, 2010).

## SECTION 5: LAND READJUSTMENT AS A GLOBAL TOOL

### SECTION 5.1: BRIEF EXPLANATION OF LAND READJUSTMENT

Land Readjustment has been used successfully as explained before and it is also a possibly successful tool to deal with the global problems of urbanization (Home, 2007a, p1). Addressing the connection between urban design and space can lead architects to plan urban design in advance. Because the prediction for the global population for 2075 is 9.22 billion (United Nations, 2004, p1), the challenge for governments and architects is to design metropolises with the right balance of density and population. Recent research shows that the economic cost of development without good design of cities with low density is too high and

there could be major economy savings in well-designed planning systems (Peiser, 1989, p194)<sup>13</sup>. According to Professor Rob Home Land Readjustment is a global tool for designing land in advance. Historically many countries used this method such as the Netherlands, Germany, Japan, etc. This method can be used exclusively for agricultural land or urban fringe land development projects for designing land development in a well-organized form. Usually this method is used in two ways: first is a voluntary repartition in which each land owner cooperates and applies the Land Readjustment scheme. The second is compulsory Land Readjustment imposed by public authorities (Home, 2007a, p2 & Sorensen, 2002, p131). Land Readjustment has different names in different countries, such as Kuku seiri<sup>14</sup> (KS) (in Japan), Umelgung (in Germany) and also Replotting, Land re-assembly, Parcellation, Repartition, Land Pooling, etc. However, the characteristics of a Land

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<sup>13</sup> Peiser is Professor at the School of Urban and Regional Planning at the University of Southern California, Los Angeles, USA (Peiser, 1989, p 193).

<sup>14</sup> In Japan Land Readjustment was disseminated through Japan's magazine published in 1935. This magazine introduced an article titled 'Kukaku seiri wa toshi kei tochi kaihatsu no kagi' (Land Readjustment is the mother of city planning and the main point of land development) (Fieve and Waley, 2003). Japanese architects started to use the Land Redjustment method in landscape design in the early twentieth century, Three main catastrophes influenced them to use this method; the first one was the massive earthquake in 1923 and the demolition of some cities after World War Two (Larsson, 1997). The third one was that the number of people increased dramatically between 1955 and 1965. At that time figure shows that over just ten years the number of people increased more than 40% (Guller, 2005). As a result of this three facts the Land Readjustment method became the most important method to create the good urban design for post-war reconstruction and became law in 1954 (Guller, 2005).



Readjustment policy flow from the same seven key stages (Home,2007a, p3 ) (table 2).

|                    |   |
|--------------------|---|
| <b>Initiation</b>  | Normally by request to an administrative unit of local government from an absolute majority of proprietors in a specific area. Dissenting property owners could be compelled to provide their land to the scheme.   |
| <b>Declaration</b> | The frontier limits of the planning arrangement are set under the law, by a public or private authority.  |
| <b>Plan</b>        | Preparation of a renovation plan, deciding the future uses and re-development of the route and scheme layout. This can categorize, for instance, structures for destruction or preservation, road closures, proposed community zones and allocate plots to the development agency to fund sub-structures. |
| <b>Measurement</b> | Computation of plan zones before and after parcellation. Plan dimensions can be reduced by roughly 20% for infrastructures and up to 50% for community spaces and public facilities.  |
| <b>Costing</b>     | Approximation of forthcoming market price of re-adjusted schemes and prices of sub-structures.  |
| <b>Allocation</b>  | Completely serviced schemes are reallocated back to property owners, regularly situated as close as possible to the original location.  |

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|                       |   |
|-----------------------|---|
| <b>Implementation</b> | The allowing administrative organs funds sub-structures through the sale of reserve or cost-equivalent plans, usually by auction. |
|-----------------------|---|

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Table 2: shows the seven key stages of Land Readjustment when applying the scheme (Home, 2007a, p3 & Home, 2007b, p461).

## SECTION 5.2: DESCRIPTION OF LAND READJUSTMENT AND TECHNICAL POINTS

Basically Land Readjustment is a method to rearrange land use. It is used in agricultural land where there is a group of fragmented, cheap farming land (with low productivity). The technique is a replotting process whereby each land owner of irregular plots of land is reassembled to more regular plots of farming land (Sorensen, 1999a, p2333). The process forces and promotes each land owners to provide selected proportion of their land holding for community and public places. Each land owner should offer roughly 30% of their own land to be used for public space, open space, parks, roads and cycling roads. This type of parcellation is unique because all land owners increase the value of that land by this method of replotting. Furthermore, because there are fewer leftover plots than there would have been before this scheduling, the price of the remaining plots rises substantially through this reconstruction. After replotting plots, the owners of the Land Readjustment scheme (government or the private sector) can sell the remaining fragments of the idle land at the end of the project; the income of the sales can also be used to pay the costs of development and structure of the scheme. Figure 25 illustrates how Land Readjustment is used for the replotting of uneven and low productive agricultural land (figures 25, 26) (Sorensen, 1999b, p52 & Sorensen, 1999a, p2334).

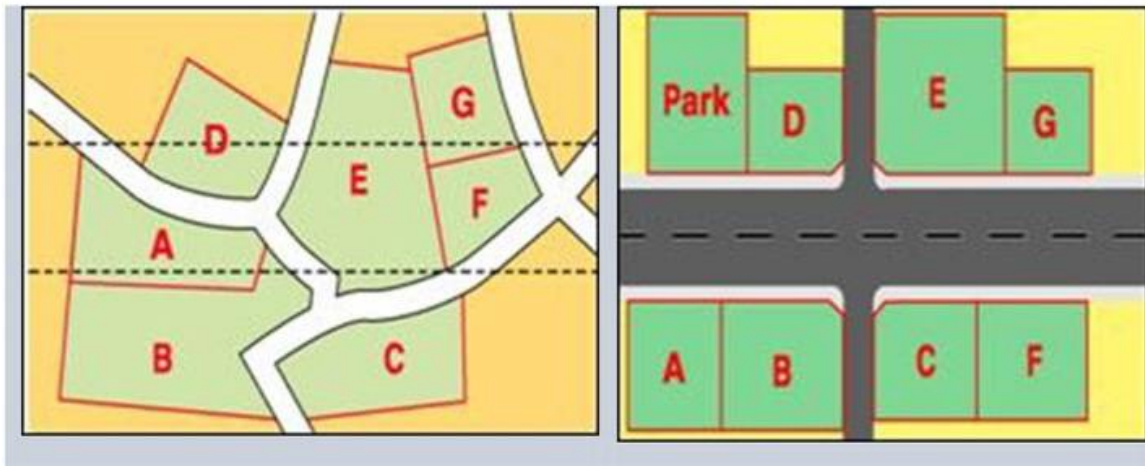
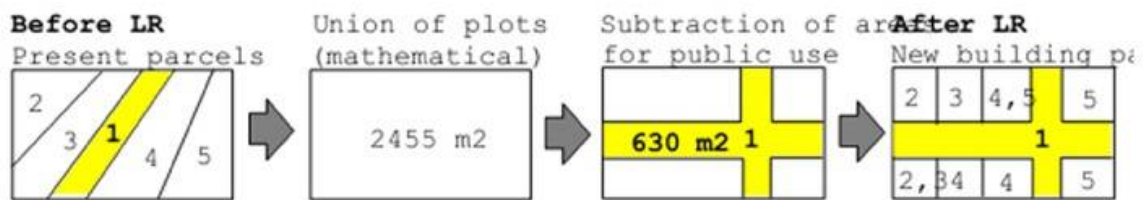
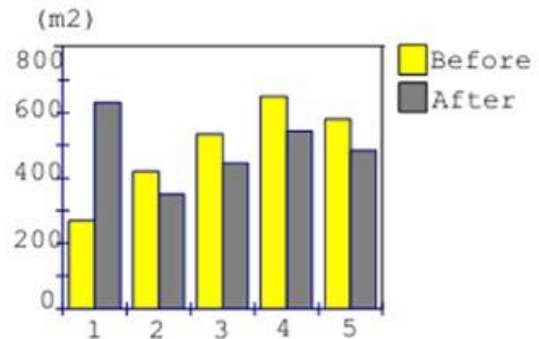


Figure 25: shows the application of Land Readjustment is used to divide unproductive land and change to well-designed and constructive rural site plans (Photograph by the official site of Town and Country Planning Department, Peninsular Malaysia, 2006).



| Parcel ID | Parcel size (m <sup>2</sup> ) |       |
|-----------|-------------------------------|-------|
|           | Before                        | After |
| 1         | 270                           | 630   |
| 2         | 420                           | 351   |
| 3         | 535                           | 447   |
| 4         | 650                           | 543   |
| 5         | 580                           | 484   |
| Sum       | 2455                          | 2455  |



$$\text{Contribution rate} = (630 - 270) / (2455 - 270) = 0.215$$

Figure 26: shows an example of rural Land Readjustment. The size of each land before and after replotting process. The size of each land decreases after Readjustment, but the size of the public road (highlighted in the picture) rises radically (Photograph by Yomralioglu and Parker, 1993).

As can be seen in Figure 27, Land Readjustment has different steps of reconstruction. The method changed rural land into urban land to provide better conditions in high density areas with ample public roads and parks.

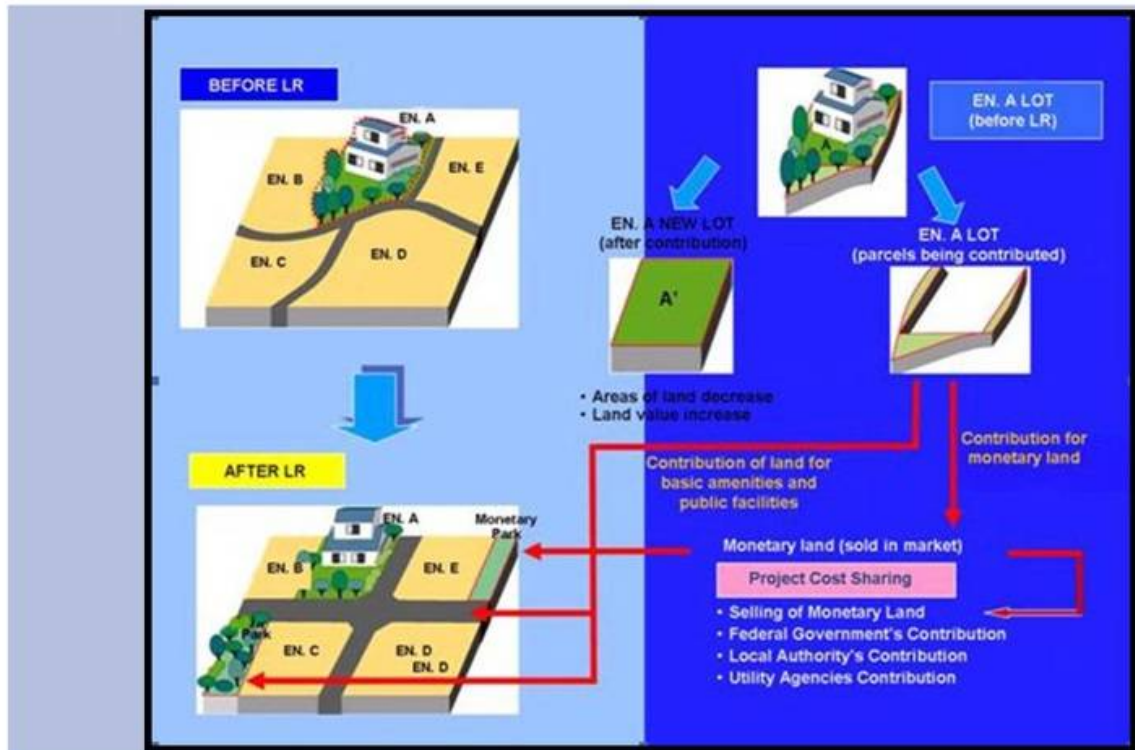


Figure 27: shows the steps of Land Readjustment. A Group of rural plots of land (top left) are submitted to the Land Readjustment scheme and each part of land changes to a new plot after contribution (top right) the remaining plots of land have two different possibilities. The first one brings public facilities for the community such as parks and roads (down left). The second one brings the remaining land for sale at the end of the project, to recover the cost of project after the scheme. The project has a self-financing character and doesn't need any sponsor or investors to cover the finance of regeneration of reconstruction (poster by Supriatna, 2011 & Japan Ministry of Construction, 1997).

### SECTION 5.3: KEY CHARACTERISTICS OF THE LAND READJUSTMENT METHOD

Land Readjustment presents five key features. First of all, Land Readjustment is a comprehensive tool for undertaking city design and effective metropolitan betterment. For instance, it allows the structure of urban amenities in inhabited zones, such as garden parks, and permits apportioning land into lots in a scheme zone. Likewise, Land Readjustment can support a flexible technique to grade and size plots of land (Balla, 2005, p5 & Supriatna, 2011, p 60).

Secondly, Land Readjustment allows a reasonable distribution of the benefits and costs of the scheme. Land Readjustment can play an important role in urban design as it secures a financing tool for each proprietor. As every proprietor can achieve the urban capacity in the same way, the benefits are also fairly spread between them (Balla, 2005, p5 & Supriatna, 2011, p60).

Thirdly, Land Readjustment preserves the land titles throughout and after the scheme. The new plots of lands are shared among the proprietors and agreement is given for expropriation or sale as an alternative. Land Readjustment is consequently a win-win situation (Supriatna, 2011, p 60 & Balla, 2005, p5 ).

Fourthly, a Land Readjustment method is a democratic and independent scheme that reproduces the division of land in a rational and logical method (Balla, 2005, p5 & Supriatna, 2011, p60).

Finally, Land Readjustment ensures transparency in the development. For instance, general group meetings of proprietors are undertaken. In

the operation, a consultative council of representatives of proprietors is established along with the local management in order to conform to the actions and processes of regeneration (Balla, 2005, p5 & Supriatna, 2011, p60). (The above is exemplified in figure 28).

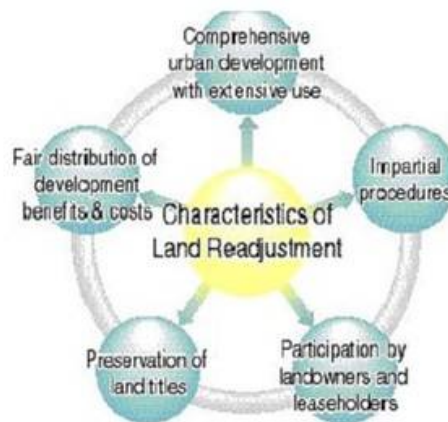


Figure 28: Land Readjustment and its characteristics (Photograph by Japan Ministry of Construction, 1997).

#### SECTION 5.4: GENERAL CONDITIONS, FOR THE LAND READJUSTMENT METHOD APPLIED IN EACH COUNTRY

Some conditions of Land Readjustment make this method less practical in some countries. For example, historically, in the United Kingdom, Land Readjustment has never existed for the regeneration of land owing to cultural and political issues. The main one being that private developers and private property rights oppose the use of this method in England<sup>15</sup>

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<sup>15</sup> The method adopted took its name from Augustus Andrewes Uthwatt (1879-1949) (chairman of the Authorities Commission on Compensation and Betterment) in a report called the Uthwatt Report (1942). This report had a significant effect on nationalization and development rights in the reconstruction schemes of land after World War Two. However, this development scheme was rejected by private pooling schemes in England. This report influenced Land Readjustment in different countries such as Japan, but not England (Home, 2007a, p4 & Home, 2007b, pp477-478, & Moore, 2005, p3 & Monson, Monson, 1949, p176).

(Home, 2007a, p4 & Home, 2007b, p 475). Land Readjustment schemes are highly sensitive political issues and situations are different in the property market in each country. It therefore has diverse local roles. A successful Land Readjustment scheme increases the property market fairly amongst all plots involved and individuals accept the increasing value of each parcel of land after the regeneration of areas. Moreover, the value of all land in this scheme should be equivalent for all plots of land after the readjustment (Home, 2007a, p4 & Yomralioglu and Parker, 1993, p5). Because of the egalitarian and developmental characteristic of Land Readjustment, the method can be easily rejected by elites (speculative land owners) that would not benefit.

Controversy for this method is all related to the fact that Land Readjustment provides a prediction of the land value after the scheme. This means that Land Readjustment has become a method of estimation of the extra value acquired in each plot of land so the calculation of the value can be possible and therefore predictable. This calculation is based on mathematics and the subjective judgement of different property markets. The prediction of land value after Land Readjustment can be calculated using the below formula (Yomralioglu and Parker, 1993, p5) (figure 29).

$$V_i = \text{AREA}_i * \sum_{j=1}^k (f_{ji} * w_j)$$

**V** : Total value of a parcel      *k*: Total number of factors  
**Area** : Land parcel size      *n*: Total number of old parcels  
**f** : Factor value      *m*: Total number of new produced parcels  
**w** : Factor weight

Figure 29: how the increase of value for each plot of land calculated after the regeneration of an area via Land Readjustment. This formula and factors can be affected by social, economic and political issues in different countries (Yomralioglu and Parker, 1993, p5).

Land Readjustment has four conditional stages for application. The first one is a flexibility of political acceptance of municipalities to share the development value between land owners and public agencies. The second one is the technical experience of development agencies in the application of the scheme. The third one is an adequate cadastral record for the project. The fourth one is a legal acceptance of a regulatory framework with resolution mechanisms (Home, 2007a, p4).

## **SECTION 6: THE USE OF LAND READJUSTMENT IN THE URBAN DESIGN OF ROTTERDAM**

### **SECTION 6.1: BRIEF HISTORY OF LAND READJUSTMENT IN THE NETHERLANDS**

According to Barrie Needham, Land Readjustment played a general role in designing the Dutch countryside. More than two-thirds of the total agricultural land in Holland has used the Land Readjustment method to



improve the quality of life and to ameliorate sprawling during the second half of the twentieth century (Nelson, 2009, p9).

Concerning history, Land Readjustment was used at the beginning of the twentieth century in the Netherlands. The process started with Land Consolidation<sup>16</sup> legislation that facilitated holdings in land in the countryside. This Legislation was passed in 1924 which was called (*Ruilverkavelingswet*) (Needham, 2002, p5 & Van Den Brink, Molema, 2008, p428). However, this was not successful due to the fact that most of the cost of the scheme was paid by the land owners. For this reason, the legislation of Land Consolidation was changed because it was quite easy for land owners to avoid and block the process (Needham, 2002, p5). The law was reviewed in 1938. After World War Two, the reconstruction movement of agricultural land started and 22,000 hectares of land were readjusted per year between 1946 and 1959, in comparison only 23,700 hectares of land were readjusted during the 21 years between 1924 and 1945. This shows that the scheme of Land Readjustment became successful after World War Two in the Dutch farmland (Needham, 2002, p5). The main reason for using this method was to facilitate road construction and good transportation in farm land to improve their productivity. After the World War Two the Netherlands suffered hunger and the country needed to support food production (Needham, 2002, p5). Another reason for using this method was the unique position and geography of agricultural land in the Netherlands.

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<sup>16</sup> Land consolidation is a type of land reform in agricultural land which merges each plot of farm land into a large plot of land rather than small parcels of land at the end of scheme.

The ground water level is high, it was therefore difficult to use agricultural machinery on each parcel of land and the access to each parcel was poor (Needham, 2002, p5).

### SECTION 6.2: THE USE OF LAND READJUSTMENT FOR THE URBAN DESIGN OF ROTTERDAM

With regard to the urban design and planning system for Rotterdam the city centre was rebuilt from 158 ha to 258ha in city, this means that the new city had an extra 100 ha in the city as public space. As a result the old medieval parcellation completely changed with the method of compulsory Land Readjustment (Needham, 2002, p11). The complex historical system of property rights created difficulties for the regeneration of land in the city centre. For this reason, the municipality used better-defined and more practical ways of using Land Readjustment in a compulsory manner to solve their problems in the city centre. The use of Land Readjustment in this case was different to the traditional agricultural use in the Netherlands, Land Readjustment is used in agriculture because a lots of farm land being fragmented and ill-suited for modern agricultural uses (Nelson, 2009, p8).

### SECTION 6.3: ROTTERDAM AFTER THE REGENERATION

The new city centre of Rotterdam became a commercial centre with a range cultural amenities and administrative office. Industries were excluded from the city centre and traffic was rerouted. As a result the urban design and the condition of the city centre completely changed, the new city had ample streets with proper cycling routes, huge parking spaces, broad public gardens and plenty of open spaces for the public. In addition, the new design is restricted in housing with only 10,000 flats for

habitation. As explained before near 24,000 houses were completely demolished during the war. Under the scheme the minority of their houses were allocated to the suburbs outside the city. As a result of this modern urban design, 70% of the total area in the centre was open public space. This is an important change because before the war only 45% of the land in the city centre was available for building sites and 55% was open space (Diem, 1967, p15). This regeneration of Rotterdam influenced the contemporary metropolitan characteristic of the city: its dynamism, the space, the quality of air, the openness, the rationality and the modernity as a whole. Those characteristics nurtured the condition for the achievement of an ideal balance of life and work in Rotterdam. As a result, the city has become a magnet for architects, artists, designers and other active liberal professionals who deliberately opted to live and work in this metropolis (Van ulzen, 2007, p163).

#### SECTION 6.4: CONCEPT OF THE CITY CENTRE IN ROTTERDAM AFTER WORLD WAR TWO

A regeneration process in the city centre started to create a new movement of design in Rotterdam based on the 'basic plan'. This place changed for instance the usage of boulevards and grouped areas for similar use in the city centre. This can be seen in three areas such as, Blaak-Westblaak Boulevard which is a banking sector, Coolasingel Boulevard which is a shopping centres and the Schouwburgplein area which groups buildings for cultural use such as theatres and a concert hall in the city centre (Mc Carthy, 1998, p339, Mc Carthy, 1999, p295) (figures 30 and 31).



Figure 30: shows the connection of the three areas of the 'basic plan' which are marked by three different colours; black parallel line is the Blaak-Westblaak Boulevard, the red parallel line is the Coolsingel Boulevard and the purple rectangular is the cultural area in the city centre (Photograph by author using Google map).



Figure31: shows the Schouwburgplein area in the city centre of Rotterdam. The De Doelen (left side of picture) is a place for theatres, cinema and cultural expressions. Fountains are designed on the ground in that area and modern leisure benches for people are provided. Four red structures provide lighting on to the façade of De Doelen and the ground of the surrounding area. This great open space zone was designed for street performances and as a cultural zone for people (Photograph by author).

After Land Readjustment the number of houses decreased rapidly owing to the fact that Dutch people in Rotterdam at that time preferred to live in the suburbs. The government applied a restricted plan for housing in the inner city. The new planning system only allowed 10,000 houses, before the Second World War this figure was 20,000 houses in that area (McCarthy, 1999, p295 & McCarthy, 1998, p339). Around 24,000 to 27,500

houses in the centre were completely demolished during World War Two. The need for housing created a lot of projects outside of the city such as Kralingen, Overschie districts, Hoogvliet, Pendrecht, Zuidwijk, Lombardijen and Groot IJsselmonde (please see figure 32).The municipality had two reasons to develop accommodation outside of the city. The first one was related to new government policy which attracted many immigrants to the city who needed accommodation. The post-war population growth forced the government to create housing projects outside of the city. The second one was to avoid the mistakes of the pre-war era in urban design, the landscape needed open spaces in to city centre to be used such as parks, fountains and shops for new regeneration. For this reason the municipality development 30,000 houses in the suburbs and completed them at the end of 1955 (Koolhaas, 1995, p552 & Mc Carthy, 1998, p339).



Figure 32: the black rectangular in this Google map shows the locations of the government's housing projects. The aim of the projects was to settle and

organize inhabitants outside of the city centre (Photograph by author using Google map).

The new urban structures inside the city centre zone brought about a new design structure and urban planning system to Rotterdam. The well-known post-war structure, such as Potkantoor and Groothandelsgebouw, represented the new movement of design in the city (Koolhaas, 1995, p552). For instance, Groothandelsgebouw was designed by Maaskant and Van Tijen. This structure was opened at 1953 and represented the resurrection of Rotterdam after World War Two. The building has 120,000 square metres of construction designed for trade and commercial use with parking and ramps on several floors of the building. The structure has roof terraces with a supermarket and cinema. It uses a successful 'flex- building' technology. This means that this structure was designed to respond to change and is able to accept different fit-outs and adaptations to the surroundings. In the other hand, this building has a flexible character which means that changing its function requires a limited constructional intervention. It does not require large-scale renovation meaning that the construction is highly sustainable. In terms of contemporary design this building is one example of a successful design and regeneration using a futuristic view of the development of transportation and mobility in the city (Leupen, Heijne and Van Zwol, 2005, p58 & Krol, 2005, p134). One important point in the design is the creation of a huge parking place which also offers space for bicycles. This means that, at the time, the designer tried to build a construction able to accept a huge capacity for future use. The special location of this structure is near the Rotterdam central train

station. This is the most important terminal of Rotterdam that connects European countries via train and metro stations. This sustains the demand of vehicles and bicycle users from all over Europe. However, open spaces in the surrounding area accept a large number of bicycles and vehicles (please refer to figures 33, 34, 35, 36, 37, 38 and 39).



Figure 33: shows a bird's eye view of Groothandelsgebouw in Rotterdam in 1953 (Photograph by <http://www.lgafoto.nl/album/Oud%20Rotterdam/album/slides/Groothandelsgebouw-luchtfoto-1953-IN.html>, na).





Figure 34: shows the location of Groothandelsgebouw on Google map (Photograph by author using Google map).



Figure 35: the red line shows the present boundary of the bombardment of the city centre (areas which used the Land Readjustment method) and the outside of the heavily bombardment area in the city centre. Black rectangular shows the location of Groothandelsgebouw in the map (extract by Gemeente Rotterdam 2008 with author adaptations).



Figure 36: shows the façade of north side of Groot Handelsgebouw. The picture shows the parking gate for entering and exiting vehicles. This structure can accept a variety of transport means such as motorbikes, bicycles and motorcars (Photograph by author).



Figure 37: shows the public parking place only for bicycles at the front of the

north side of Groothandelsgebouw. The cycling park is near to the train station and the Metro station (Photograph by author).



Figure 38: shows the façade of the south side of Groothandelsgebouw. Public cycle is available for people at the front of this building (Photograph by author).



Figure 39: shows huge space for public cycling at the south side of Groothandelsgebouw. This huge parking place is near to the Metro station and train station (Photograph by author).

## **SECTION 7: LAND READJUSTMENT AND OPEN SPACE**

### **SECTION 7.1: URBAN QUALITY AND THE CONDITION OF COOLSIINGEL BOULEVARD BEFORE AND AFTER LAND READJUSTMENT**

In the Coolsingel Boulevard only two buildings (the city hall and the post office) creates a remarkable contrast with others structures and a sense of pity affects visitors of the boulevard because it lacks historical structures. One of the main reasons for this is that this boulevard is presented as less European with fewer historical characteristics. Buildings and streets are completely different from European cities. However, the destruction of those constructions created a remarkable opportunity for the Dutch people. The creation of cycling roads, shopping areas and pedestrian walks in the city centre was unique. As a result the city is regarded as the most successful case of city planning and is well-known for its innovative architecture (Cavendish, 2009, p563). The basic plan of Van Traa created a new and fresh modern Dutch design planning system. The aim of this plan was to break with the traditional planning in the urban design system. However, the basic plan only kept three pre-existing streets such as Coolsingel, Goudsesingel and Boompjes ( Meyer, 2012, p3). The comparison of existing streets after and before World War Two show how Land Readjustment has worked. Coolsingel Boulevard in the city centre can be used as a good example of the effect of modern city planning and for the use of Land Readjustment. After the war the new

Coolsingel Boulevard had three main characteristics, the first one is that the city planning system changed its direction towards the Meuse River and opened up this area. Before the boulevard did not have direct access to the river area. The second one is that the modern plan created a border traffic infrastructure. The boulevard did not have junctions, traffic lights, road infrastructure, etc. The third one is that city policy brought about provision of services to this boulevard such as shops and restaurants ( Meyer, 2012, p3).

The plan of Coolsingel Boulevard in 1914 shows that at that time the boulevard did not have any cycling roads or pedestrian walks, however, the functionality for of pedestrians after the war changed and a shopping pedestrian zone was created. The open space which is related to the Land Readjustment method brought about a new way of design for the city. As a result, the municipality tried to design multifunctional construction for shopping, walking or exercising for people. Interestingly the plan of 1914 shows that originally the green tree's lines did not exist in that zone, only some parts of this Boulevard already (which had trees) did not form a line to protect pedestrians but were planted randomly. Another problem in that area was that the high density of houses created by a small distance between two buildings and only minimal open space existed between two structures. According to the Rotterdam Maritime Museum, the majority of structures did not have good living conditions and the design of buildings in that area was chaotic before World War Two. In one video in this museum the condition of houses in the city centre and Coolsingel Boulevard were described as follows:

'... The stairs are unpainted and dirty, there is no light. Our home consists of two rooms and two dark all covers with four beds. We cannot open any of the windows on the street because of the thick clouds of dust carried on the wind...' (Hein Mol)

Some research about the regeneration of the city centre shows that before regeneration the city's historical characteristics were affected by the growth of second class housing. As a result millions of people lived in bad conditions in alleys and narrow streets. For example, people lived in basements and huts in among large structures. This kind of growth in the city centre created a big problem in Rotterdam and the city centre increasingly lost its housing function at that time. However, those problems were recognized by the municipality in 1901, because at that time they introduced housing act for the city centre, but the city growth continued without any planning system (Meyer, 2012, p4). This condition of structures in the city centre was the same in alleys and streets where were open to the Colsingel Boulevard and the conditions of boulevard affected any design in the surrounding area.

The details of the site plan of the boulevard show that in that area the boulevard was large at the start and become narrower at the end area (the end area was near to the city hall and the post office). Before the regeneration the boulevard did not follow any city planning system and the dimensions of pedestrian paths and road areas was different. One of the significant points in the regeneration of Coolsingel Boulevard is the creation of a sustainable design in this area. This unique design can be called sustainable because the design supports healthy activities such as

walking and cycling. However, the boulevard has a space for public transportation too such as tram and buses. This multi-functional boulevard also provides roads in both directions and has ten spaces: two huge pedestrian paths, two cycling roads, two specific spaces near to the cycling road for the green line trees, two roads for motorcars and buses, and two roads for trams in the middle (please refer to figures 40, 41, 42, 43 and 44).



Figure 40: the Coolingsel Boulevard plan with surrounding area in 1916. Parts of the urban design of the city centre. The position and distance of each building can be seen in this plan before World War Two. Red shapes show the post office and the city hall which still exist today. The blue parallel lines show the Coolingsel Boulevard and the green lines show the dimensions of the boulevard in different areas (Extract of Damen, Camp, Devolder, 1991 with author adaptations).





PICTURE A

PICTURE B

Figure 41: picture A (left top) shows the urban form and condition of the city centre without any large open spaces before World War Two. In the left corner of this picture city hall is between other buildings (Extract by Laar, Hage, Brandgrens, 2011 with author adaptations). Picture B (top right) The perspective and façade of some buildings are also shown before World War Two in the city centre (Extract by Laar, Hage, Brandgrens, 2011 with author adaptations).



Figure 42: shows a painting related to the interior design of one structure as an example of the bad conditions of living for the majority of people in Rotterdam before World War Two (Still image from a video of the area belonging to the Maritime Museum in Rotterdam, 2012 with author adaptations).



Figure 43: this photograph was taken by L.J. van de Winkel around 1920. The location of the photographer was probably on the eastern side of Schiekade Boulevard. This was the most spacious area in the city centre before World War Two. The photographer was standing on top of a structure in Schiekade Boulevard and directing the camera towards the Coolsingel Boulevard. The photo shows the location of the city hall (left top) and other buildings before regeneration. In this photo we can see the people can move to different locations without any organized boundary for pedestrians or roads. This means that the boulevard did not provide any road infrastructure and infrastructure in that zone (Van der Schoor, 2010, p233).



Figure 44: the red rectangle shows the location of the Schiekade Boulevard in today's city centre (Extract of Google map with author adaptations).

## SECTION 7.2: SAFE WALKING FOR PEDESTRIANS IN COOLSINGEL BOULEVARD AFTER REGENERATION

One of the significant points in the regeneration of Coolsingel Boulevard is the creation of a sustainable design in the twenty first century. This unique design supports healthy activities such as walking and cycling. Because of that the feelings that is produced are ones of safety and freedom (please refer to picture 46).

The most common way of protecting pedestrians on a boulevard is the design of curbs and pavements that separate pedestrians from vehicles. In this way design supports a sense of safety and tranquillity for people. The boulevard is also in close proximity to trees and their curb line creates a safe pedestrian zone for people (Jacobs, 1995, p270). Coolsingel hence provides a safe pedestrian zone. At most places the creation of green line trees near to the cycling road and the distance between each tree in this boulevard brings about a safe line between the cycling road and the vehicle road. In contrast, Coolsingel in 1916 was a narrow street. This changed after regeneration and trees were located to protect pedestrians. Consequently, all of this unique creation is related to the created of open spaces in the new urban design of Rotterdam. The mechanisms of Land Regeneration used have, therefore, enabled the creation of these facilities and the safe and calm feeling engendered today. The regeneration of the city centre with this technique hence has created a unique area of urban design where there is a balance of urban use and safe pedestrian culture. However, this way of design that includes a tree zone in boulevards not only reinforces a safe pedestrian

zone in cities, it also reduces the CO<sub>2</sub> of the same cities creating healthy environment for people.

### SECTION 7.3: PHYSICAL AND PSYCHOLOGICAL HEALTH IN COOLSINGEL BOULEVARD

New research about improvement of streets and boulevards in the USA shows that the physical and psychological health of people is positively related to urban design. If people have access to green spaces and attractive open spaces this can provide better conditions for living. For example, streets and boulevards with open spaces give a place for rejuvenation and relaxation. In addition, the open and green spaces can encourage social interaction as it creates an inviting and liveable place for people. As a result the quality of the environment for pedestrians improves and also has a positive economic impact on the area ((SOSIP), 2011, P1)<sup>17</sup>. A pedestrian-friendly urban design therefore provides safe cycling roads with safe walking areas and related facilities such as restaurants and shopping areas. These kinds of facilities in boulevards or streets support an active living environment and bring about social interaction. As a result, the pedestrian- friendly urban designs improve physical health and can also reduce mental stress ((SOSIP), 2011, p1).

After World War Two Land Readjustment methods brought about a pedestrian-friendly environment with huge open spaces in the city centre of Rotterdam. Land readjustments made later development possible, such as the cycling road, and unleashed the capabilities and creativity of

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<sup>17</sup> SOSIP is the acronym of 'Street & Open Space Improvement Plan'. It is an American organization for developing and enhancing capabilities of cities in USA. This organization is funded by the Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments (ABAG) in the USA.

Dutch architects. Land Readjustment therefore enabled and nurtured a creative culture of urban design. However, the cycling road in Rotterdam was created after World War Two. The Coolsingel Boulevard changed dramatically with this technique of modern urban design. The open spaces gave the Coolsingel Boulevard three different functions in the area. The first one is its large walking pedestrian zone with restaurants and shopping stores. The second one is the safe cycling road also used by wheelchair users or disabled people using mobility scooters. Cycling roads are a feature all over the city centre and also the facilities for walking pedestrians, the cycling road and the tram line started from the Coolsingel Boulevard towards the end of Erasmusburg Bridge. The third one is the creation of a green line of trees in that zone which brings about a sustainable environment effecting the city and reinforcing a safe cycling and pedestrian zones in this boulevard (please refer to pictures 47, 48, 49 and 50).

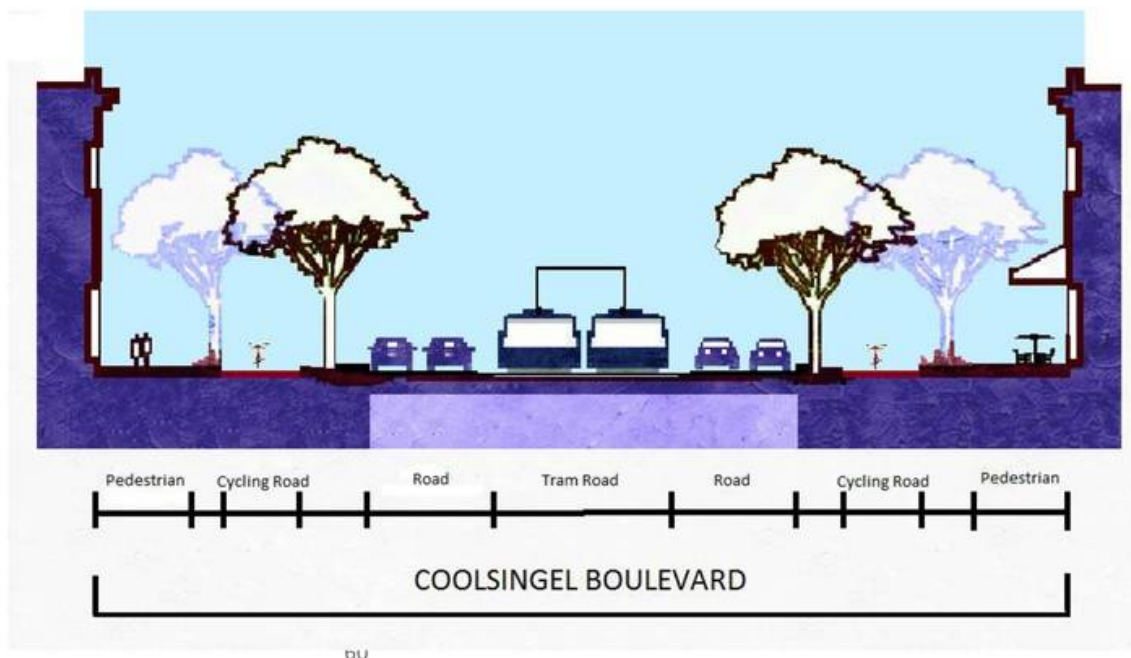


Figure 45: a section plan of Coolsingel Boulevard in the twenty first century. The multifunctional dimension of the boulevard supply for pedestrians, cyclists and tram users (section plan by author).

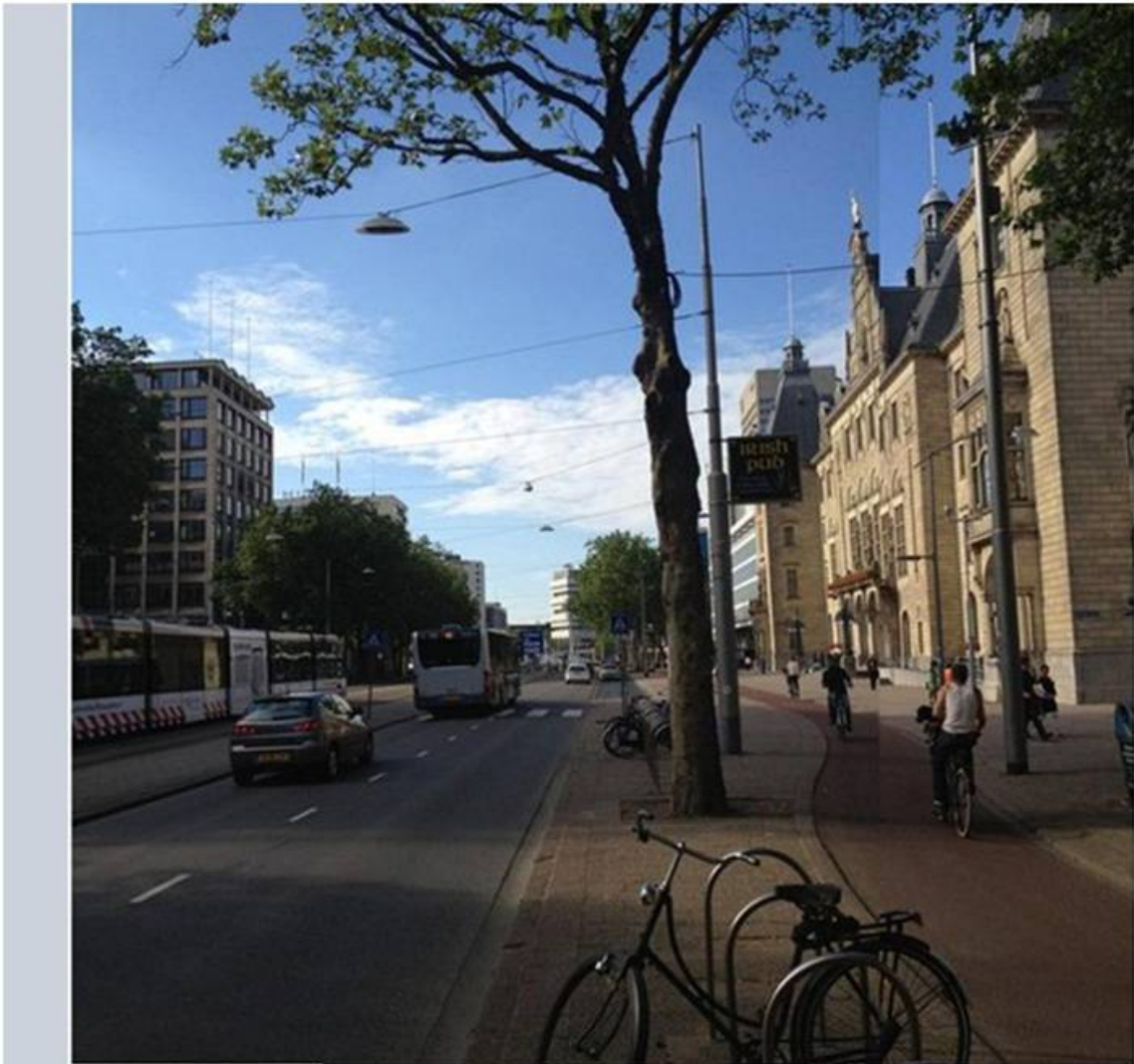


Figure 46 : shows Coolsingel Boulevard with five specific spaces. First space (right side of photo near to city hall) is pedestrian space. Second space (near to the pedestrian space) is cycling road. Third space (left side of cycling road) is the green line space made up by trees. Fourth space is road for public transportation

by buses and cars. Fifth space is road for trams in the middle of the boulevard. In total this boulevard has five different spaces supporting different functions (photograph by author).



Figure 47: shows that the cycling road in Coolsingel Boulevard is a safe cycling road that provides a feeling of calmness and security. People can travel without worrying about the dangers of vehicles and also Dutch people with disabilities can use wheelchairs or electric wheelchairs on this same cycling road (photograph by author).



Figure 48: picture A shows the condition for safe shopping for pedestrians near to a shopping mall in the Coolsingel Boulevard. This area was designed with leisure benches and with two green tree lines between the cycling road and the shopping area. One of the great features is this green line of trees as it provides an area for bicycle parking between trees in the green line areas to provide better conditions and facilities for cyclists (photograph by author). Picture B shows the red star with an arrow on the Google map. This sign highlights the location of where the picture was taking by the author. The camera was directed towards the north side of Coolsingel Boulevard. The red rectangle shows Bulgersteyn Street near to the location of photographer. The green zone on the map shows the green open space in the surrounding area near to the Coolsingel Boulevard (extract of Google map with author adaptations).





Picture A



Picture B

Figure 49: picture A (top left) is a one point perspective photo of the Coolsingel Boulevard towards Hofplein Square (photograph by author). Picture B (top right) shows Hofplein Square near to the Coolsingel Boulevard. The city provides a unique square with green grass on the tram line with fountains and flowers in the surrounding area. The tram line is designed with the usage of green grass creates a sustainable environment and enjoyable feelings for inhabitants (photograph by author).



Figure 50: shows the conceptual model of urban design. Coolsingel Boulevard (right corner) and surrounding area are shown in this model. Although the position of all buildings in that area is not exact, the urban design and the relationship between the square, junction and boulevard, as well as the cycling roads (red line), roads, pedestrians paths and tram road is an exact reproduction and measured using a scale of H0 (1:87) (photograph taken by author in 'Mini World Rotterdam', 2012).



Figure 51: shows the Rotterdam cycling map with a guide map (a guide map is present in Dutch and English in front of each icon). The green line presents a cycling road network in the city centre. Green highlight shows Coolingsel Boulevard and the red line highlights cycling roads continuing up to Erasmusburg Bridge (in a red rectangle on the left of the map) in the city centre. The scale of the map is 1:50.000 (Stadsregio Rotterdam Op de fiets, 2012) (extract by cycling network in Rotterdam 2012 with author adaptations).





Figure 52: shows the Erasmusburg Bridge<sup>18</sup> in Rotterdam. It is created for cycling and pedestrians for walking and jogging in both directions. However, the bridge not only provides a sustainable zone for the city, it also facilitates public transportation and vehicles, such as trams and vehicles in both directions. These facilities are the continuation of the Coolingsel Bulverde until end of Erasmusburg Bridge that crosses the River Meuse (Photograph by author).

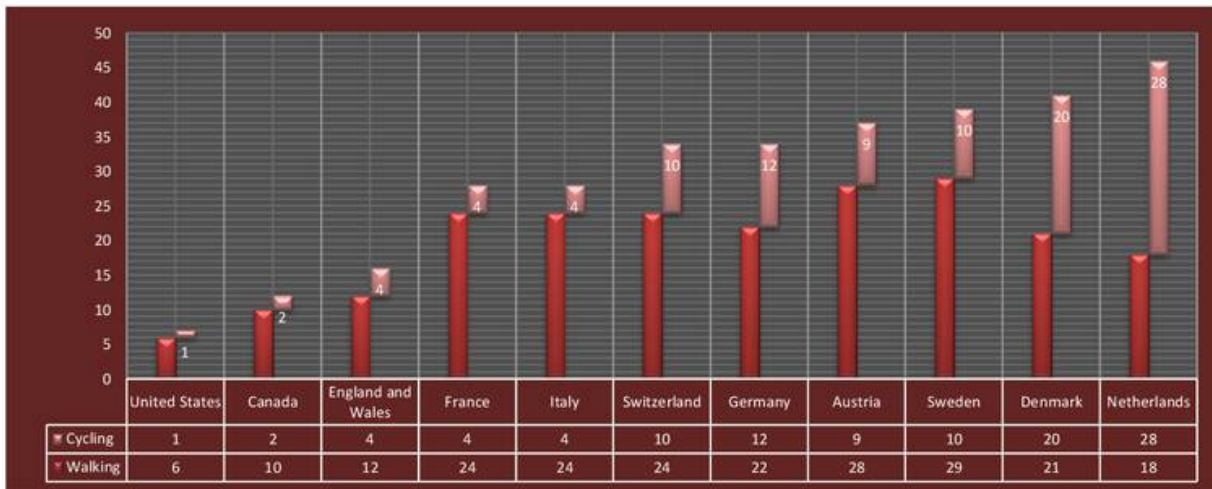
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<sup>18</sup> Erasmusburg Bridge was opened in 1996 and has become a landmark for Rotterdam. This bridge connects two major boulevards, the Coolingsel and Schiedamsedijk Boulevards on the north bank to the Laan op Zuid Boulevard on the south bank (Van ulzen, 2007, p191).

### SECTION 7.4: USING OPEN SPACES FOR PHYSICAL ACTIVITY (CYCLING)

The creation of the open space in the city centre created the conditions for a better urban environment and improved quality of life for the inhabitants of the city (Maruani and Cohen, 2007, p2).

A good environment in the city can support healthy behaviour for people. It is known that urban obesogenic environments change the lifestyle of city people and induce them to become overweight and obese (Open space, 2007, p8). In the case of Rotterdam the creation of open spaces via parks, ample roads and cycling roads has brought about healthy concepts such as the use of the bike for travel into the city centre. This had the effect of reducing the obesity of urban dwellers. According to recent research on cycling and walking in different countries, Dutch people are considered to cycle more than any nation in Europe and North America (Pucher and Dijkstra, 2003,p1511) (Bar Chart 1).



Bar Chart 1: shows the percentage of walking and cycling trips in urban areas in different countries in 1995 (Pucher and Dijkstra, 2003) (bar chart by author).

Mainly this great achievement is related to the construction and urban planning of cities after World War Two. Rotterdam is the second largest city in the Netherlands and its reconstruction played a key role in the creation of a cycling culture across the country. In the United States and other countries, walking and cycling are not part of urban design. Research on cycling in America shows that cycling is seen to be more dangerous than driving a motorcar in cities. Bar chart 2 shows that in 2001 the percentage of people who are killed by accident on the roads in the USA is 12 times higher than deaths of car occupants. A comparison between Dutch cyclists and American cyclists shows that American cyclists are killed by accident three times more than (Bar chart 2) (Pucher and Dijkstra, 2003, p1512).



Bar chart 2: Shows human death and injury in the Netherlands, Germany and the United States with emphasis on cyclist and pedestrians in 2000 (Pucher and Dijkstra, 2003) (bar chart by author).

However, the increase of cycling in Rotterdam as an activity is not only related to urban design of the city, but also Netherlands has been well-known for using bicycles as a significant mode of transport in Europe. Two Dutch historians of technology, Frank Veraart and Adri Albert de la Bruhze, conducted a comparative research with statistical analysis of bicycle traffic in several European cities in the 1960s. At that time they found that cycling in the city was not only an important means of transport, it also brought about sustainable ways to transport people (Ebert, 2004, p349). Though, after World War Two in the early 1960s large numbers of people in Europe drove vehicles in the city, after World War Two in the Netherlands a large number of bicycles were present on the roads in each town or city of Holland. This number of cyclist grew from cities, such as Amsterdam and Rotterdam, to smaller villages such as Zuid-Limburg which is a predominantly rural area (please refer to pictures 53 and 54).



Figure 53: shows Hofplein Square in Rotterdam with cycling roads in the 1960s (photograph by Duivenbode, 2009).



Figure 54: shows Hofplein Square and traffic system and cycling road in Rotterdam in 1958. At that time cycling roads were divided from vehicle roads by a boundary line. This picture is a record proof that in Rotterdam after regeneration was capable enough for accepting cars and bicycles in a modern traffic system (photograph by Duivenbode, 2009).

However, these two Dutch researchers went on to conclude that the increase of cycling is due to two facts. The first one is urban design which can play a role in making it more popular and the second factor is the positive 'image of the bicycle' which a significant effect on political, social and traffic legislation (Ebert, 2004, p349). However, in terms of urban design if Rotterdam had not used the Land Readjustment method in the city centre for its regeneration it would not have achieved such large cycling roads, with the subsequent effects and magnificent environment



described in this research. This can be demonstrated in the sequence of pictures A to F in figure 55.

Picture A

Picture B



Picture C

Picture D



Picture E

Picture F



Figure 55: the sequence of pictures shows the condition of roads, the open spaces and green line spaces of the city centre of Rotterdam in the twenty first century. These pictures do not show cycling roads, tram roads or pedestrian zones. In those pictures the city centre is only designed with green line trees. The main point of these pictures is to show the concept of road and boulevard space in that area. It is based on the reality and position of different possible constructions in the city centre. The pictures also show Hofplein Square in the middle, Pompenburg Boulevard (right side of Hofplein Square), Weena Boulevard (left side of Hofplein Square) and Coolensingel Boulevard (City Hall highlighted on this boulevard). Picture A (top left) shows the concept of the current condition of roads, buildings and open spaces. Picture B, C, D, E, show the process of changing the city with high density and without the open spaces. F (bottom corner) shows the city centre regenerated under a different urban plan without the Land Readjustment method. Consequently, if Rotterdam had not been regenerated using the Land Readjustment method after World War Two, it would have had the same problems (open space) that other cities in the world have in the twenty first century.

Photograph captured by the author from animation about Rotterdam in the museum of Netherlands Architecture Institute(NAI) specifically in the section of design exhibition from different cities in the world. (Extract by Museum of Netherlands Architecture Institute (NAI) in Rotterdam 2012 with author adaptations.)

It is important to know that open spaces in that area support different types of public transportation. Nowadays Coolensingel Boulevard not only supports sustainable transportation, such as cycling and walking, it also has a great underground system which can easily be accessed from different parts of this boulevard. For example, people can easily access the Beurs Station and Stadhuis Station via the boulevard (figure 56).



| Rotterdam guide map |  |
|---------------------|--|
|                     | Public transport node. line numbers: see also separate entries junction      |
|                     | Railroad station, Daily driving  |
|                     | Underground lines A, B, C, D, E (former border crossings in the city centre) |
|                     | Tram line with tram station  |
|                     | Bus line with bus station  |
|                     | Bus line with daily service  |
|                     | Bus line with limited daily service  |
|                     | National express bus route   |
|                     | Line with local bus stop, driving with limited service                       |

|   |                      |
|---|----------------------|
|  | Fast ferry/ waterbus |
|  | Hospital             |
|  | Cemetery             |
|  | Stadium              |
|  | P+R(Park and ride)   |
|  | Airport              |
|  | Erasmus University   |

Figure 56: shows the Rotterdam public transportation map of 2012. This map shows that in the Coolsingel Boulevard people can access the three types of public transportation. Firstly, underground stations (Stadhuis Metro Station) on the north side of the boulevard near to Hofplein Square and (Beurs Metro Station) on the south side of Coolsingel Boulevard and near to Schiedamsedijk Boulevard. Secondly, the bus station (red line) where people can access the bus station on the north and south side of the boulevard in both directions. Thirdly, the tram zone in the middle of the boulevard from both directions which starts from Coolsingel Boulevard (red rectangle in top side of map) and goes to Erasmusburg Bridge (red rectangle at the bottom of the map) (Openbaar Vervoer Stadsregio Rotterdam, 2012) ( extract by Rotterdam public transportation map in Rotterdam 2012 with author adaptations).

## **SECTION 8: CONCLUSION**

The post-war history of Rotterdam can lead to important conclusion for architects and urban designers all over the world. This great city shows that well-designed city planning in advance can not only help a municipality encourage exercise and healthy habits in society, but can also change the social and environment culture in cities. For instance, successful regeneration of the city centre of Rotterdam after World War Two created a sustainable urban space in this city. This great achievement was not based on coincidence, but by careful and intelligent planning of urban design which followed a sustainable method. This regeneration of the city follows the special urban design planning method called Land Readjustment. Land Readjustment divided the land in the city centre in a special way and this division created the open spaces, parks, shopping areas and pedestrian and cycling zones. The city of today does not support an obesogenic environment common to the unsustainable environments of some modern cities. The characteristics of Land Readjustment therefore have created the cycling roads, the tram roads and the huge pedestrian zones with the green line of trees for the pedestrians. This special design brought about a cycling habit for huge numbers of Dutch people instead of using vehicles which is not sustainable for urban design. Most Dutch people prefer to use bicycles and public transportations or walk in the city centre. However the Land Readjustment method cannot be applicable universally because cultural and political issues in different countries influence the urban design. Urban design is closely related to an agreement between government and land owners.

It can be concluded that a definite degree of Land Readjustment is always essential. The greatest course of action should be to accomplish a balance between the requirements of Land Readjustment in one hand and sustainable liveable places in the city on the other.

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