



**ADDIS ABABA UNIVERSITY
ADDIS ABABA INSTITUTE OF TECHNOLOGY**

**ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED
RAILWAY TRACK**

By
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B.Sc. in Civil Engineering
Addis Ababa University

A Thesis Submitted to School of Graduate Studies in
Partial Fulfillment of the Requirement for Degree of
Master of Science
in
Railway Engineering

Advisor
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**Addis Ababa University
School of Graduate Studies
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DECLARATION

I, the undersigned, declare that this thesis is my original work performed under the supervision of my research advisor Dr. Henock Fikre and has not been presented as a thesis for a degree in any other university. All sources of materials used for this thesis have also been duly acknowledged.

Name Nahusenay Tesgera

Signature _____

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ABSTRACT

A railway track will deteriorate when exposed to repeated traffic loadings and with it, track alignment changes and track level settlements will also occur on selected areas of a given stretch. This irregularity created due to repetitive use of the system will shorten the intended service life of the track components unless elements that induce deteriorating effects are studied and monitored well.

This research focuses on the study of the root causes of uneven settlements of a ballasted railway track system. The study will investigate into identifying what the frequent causes of differential settlement of ballasted railway tracks are. After assessing the basis of this condition, the impact uneven settlement has on the track system will be surveyed with the help of extensive literature review of studies made about similar cases.

Alongside this, in order to fully understand and quantify the settlement behavior of the track system, the proposed approach will be to model the existing ground condition of the track system (using track component material properties) using a computer programmed tool named ABACUS and analyze the anticipated settlement behavior of a selected sampled section under investigation.

The findings of this study will be the derivation of profile characteristics of sample potentially differentially settling section in the Addis Ababa Railway Transit line and thus show that specific area of the transit line need frequent inspection due to its unique behavior.

Chapter 1 Introduction

1.1 Background and Problem Definition

The railway transportation system plays an important role in providing a good transportation system in a country. Compared to other means of transportation, railways have the capacity to be more efficient means of movement considering the length and quantity of passengers/goods to be transported but with a huge initial investment cost as a primary obstacle. Once the huge investment cost of the track system is spent on building the track system and infrastructures, a very large portion of the operating cost is spent to sustain the railway track system in track maintenance expenses. In the past, most attention has been given to the track superstructure consisting of the rails, the fasteners and the sleepers, and less attention has been given to the substructure consisting of the ballast, the sub ballast and the sub grade. Even though the substructure components have a major influence on the cost of track maintenance, less attention has been given to the substructure because the properties of the substructure are more variable and difficult to define than those of the superstructure (Selig & Waters, 1994).

Deterioration of the track geometry has been recognized to be the main source of the need for track maintenance. This deterioration is mainly caused by the settlement of the substructure, which tends to depend on the site conditions. Ballast is the most important component of the substructure because it is the only external constraint applied to the track in order to restrain it. Ballast is also important for providing the fastest and most economical method of restoring track geometry, especially at a sub grade failure situation. However, ballast is also one of the main sources of track geometry deterioration.

Under traffic loading, the stresses in the ballast are sufficient to cause significant strain in the ballast and ballast particle breakage. This effect causes track settlement and therefore the track geometry will deteriorate. This deterioration in track geometry will introduce differential settlements on both longitudinal and lateral direction of the railway track system which in turn will fasten the as the differential settled track help introduce dynamic loading on the track system.

1.2 Aim of the Study

The research described in this thesis aims to improve understanding of railway ballast settlement mechanism in addition to predicting the permanent actual settlement or deformation of railway track. The specific objectives of this research study are outlined below:

1. To briefly look into the root causes for differential settlement
2. To model the process using ABACUS software and
3. To analyze and compute the actual settlement case for selected case study location

Statement of Problem

In order to serve their intended design life, components of a given infrastructure have to be well monitored from elements that induce deteriorating effects. In this scope, irregularities in settlement of a ballasted railway track system have several implications that compromise the serviceability feature of the railway infrastructure. Uneven settlement of a railway track will undermine the engineering characteristic of its track components by deteriorating their structure and geometry. These deviations in structure and geometry of track components will ultimately increase the operation cost of the system, compromise the safety of passenger and freight transportation, reduce level of service and will incur additional and unnecessary maintenance and repair costs. Therefore, a thorough assessment of the causes and implications of uneven track settlement should be conducted in order to make sure that any unforeseen and unacceptably high maintenance cost of a track component is introduced.

Methodology

In order to meet the stated objectives, the following methodology will be adopted.

First, the root causes of uneven settlement of a ballasted track will be explored. A detailed literature review will be conducted so as to obtain information regarding what might cause this condition.

Second, after getting a clear view of the source of the problem, data collection will follow. The data represents the characteristics of the track components which will be used to model the

ground condition and analyze the settlement behavior of the track based on the given actual ground conditions.

Third, using the data collected, an analysis will follow to estimate the differential settlement and the results will be discussed.

1.3 Thesis Outline

This thesis is divided into five Chapters. A brief outline of this thesis is described as follows.

Following the introductory Chapter, Chapter 2 contains a literature review consisting of two parts: the first part of the literature review starts off the discussion with a brief introduction of different components of a railway track system and along with brief look into definition of differential settlement and focus on the main causes of differential settlement of a ballasted railway track. Then the second part goes on to discuss and explain the impacts of differential settlements on railways track system.

Chapter 3 describes the detailed approach used to carry out the study. In this section, the steps followed by which the final objective of the research is obtained will be discussed. Along with the techniques used to carry out the investigations, the assumptions and simplifications used to simulate the exact site condition are also explained. Continuing from this, Chapter 4 describes the results and findings of the investigation in great depth.

Finally, Chapter 5 presents the conclusions of this research and gives suggestions for future study focus areas.

Chapter 2 Literature Review

2.1 Introduction

Railway track is designed to provide an economical and safe transportation system for passenger and freight traffic. This requires a track stable enough in alignment under various speeds and axle loadings. A traditional ballasted railway track system consists of a superstructure on top of a substructure. The superstructure comprises the following components: rail, fastening system, sleepers and ties. The substructure is composed of ballast, sub ballast, and sub grade. During a train passage, the wheel loads from the train spread from the superstructure to the substructure through the sleeper-ballast interface. The functions and characteristics of every component in both the superstructure and the substructure will be further discussed.

2.1.1 Track Components

Rails are the longitudinal steel members that directly guide the train wheels evenly and continuously. They must have sufficient stiffness to serve as beams which transfer the concentrated wheel loads to the spaced sleeper supports without excessive deflection between supports. The rails also may serve as electrical conductors for the signal circuit (each rail being a separate conductor connected the train axles), and as the ground line for the electric locomotive power circuit. (Selig & Waters, 1994).

Rails are the only parts of the track component that come into direct contact with the train. Therefore, the rails transfer concentrated wheel loads to the supporting sleepers. The rails must be stiff enough to carry the wheel loads with minimum deflection between sleeper supports. The vertical and lateral profile of the rails must be coupled with the profile of the wheels, as any defect on the rail or wheel surface might cause a significant magnitude of dynamic load which is detrimental to the railway track structure.

Steel rail sections may be connected by bolted joints which are usually used on curves to provide stress relief from thermally induced length change or welding which are commonly used at preferred on lines with high speed, with high axle loads or with high traffic density. These joints may lead to large impact loads from trains that affect the track components below. The fastening system is used to hold the rails onto the sleepers, to ensure fixing of the rails. Depending on the type of the sleeper and geometry of the rail, various kinds of fastening systems are utilized. In some situations, rail pads are used on top of the sleepers to absorb the energy generated by the

traffic movements. Besides resisting vertical, lateral, longitudinal and overturning movements of the rail, the fastening system can aid in damping traffic vibrations, and prevent or reduce rail/sleeper attrition.

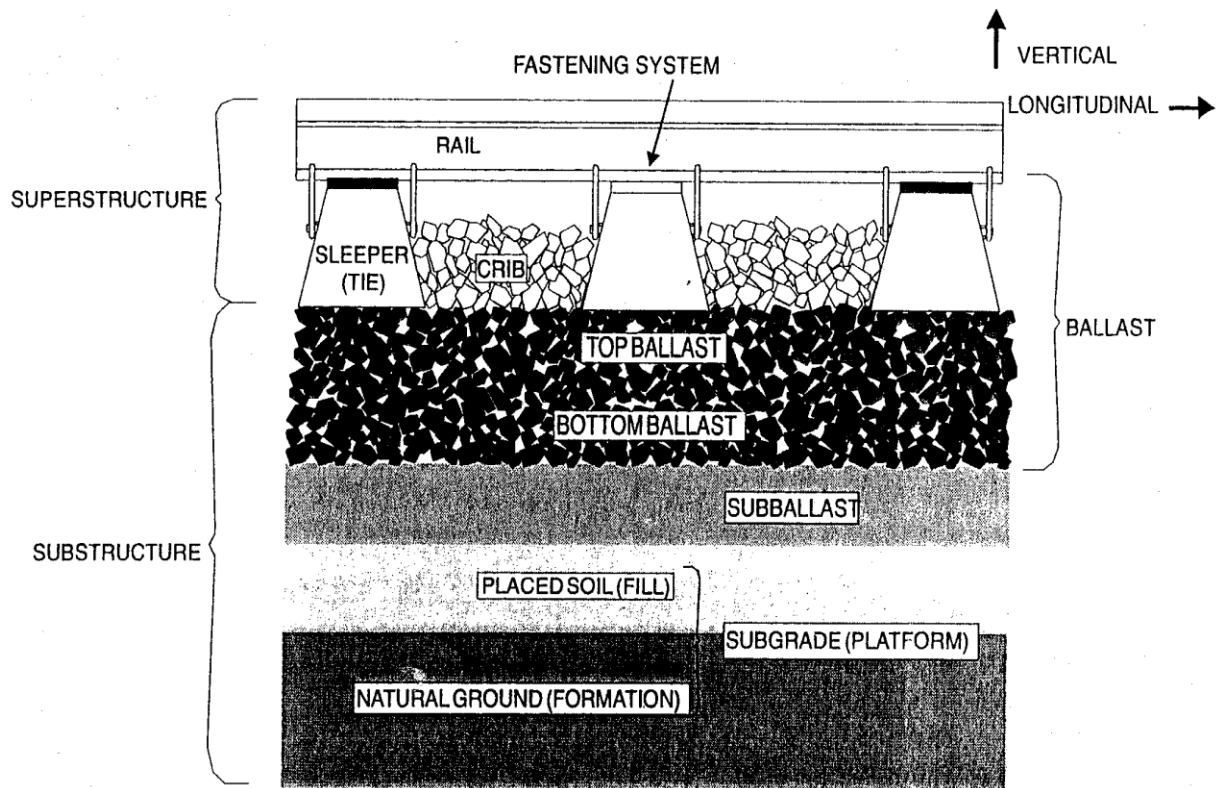


Fig. 2.1 Superstructure and substructure components of a railway line, lateral view, (Selig and Waters, 1994)

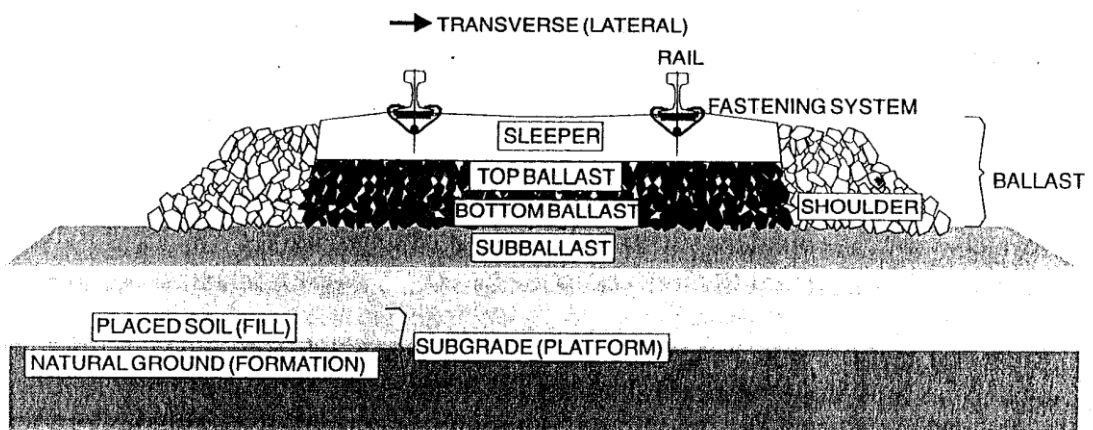


Fig. 2.2 Superstructure and substructure components of a railway line, longitudinal view (Selig and Waters, 1994)

The main functions of sleepers are to provide a solid, even and flat platform for the rails, and support the rail fastening system. They are laid on the top of a compacted ballast layer. Sleepers receive the rail loads and distribute them over a 12 wider ballast area to decrease the stress to an acceptable level. In addition, the sleepers can be used to resist lateral, longitudinal as well as vertical rail movement through anchorage of the superstructure into the ballast. Sleepers can be made of wood, concrete or steel. Currently, timber and concrete sleepers are the most common types of sleepers, which are used worldwide. Steel sleepers are expensive so this type is only used in special situations.

Railway ballast can be defined as granular coarse aggregate. According to Selig and Waters (1994), traditionally, angular, crushed hard stones and rocks, uniformly graded, free of dust and dirt and not prone to cementing action have been considered good ballast materials. Ballast is a granular material with high bearing capacity that is placed above sub ballast or sub grade to act as a platform, to support the track superstructure. Its main function is to spread the high loads of passing axles to the subgrade. In doing this, there are high stresses transmitted through the ballast. Moreover, ballast provides a certain amount of resiliency as well as energy absorption for the railway track. The source of ballast varies between different areas, depending on the quality and availability of the material. Ballast index characteristics include particle size, shape, gradation, surface roughness, particle density, bulk density, strength, durability, hardness, toughness, resistance to attrition and weathering.

Sub ballast is composed of well-graded crushed rock or sand gravel mixtures, and it sits between the ballast and the sub grade material. The sub ballast layer transmits and distributes stress from the ballast layer to the sub grade over a larger area to reduce the magnitude of resultant stress. Furthermore, another important function is to prevent interpenetration between the ballast and sub grade layer. Sub ballast acts as a filter to stop upward migration of sub grade particles into the ballast and penetration of coarse ballast into sub grade. In particular, some of the functions of the sub ballast may be achieved through the use of sand or geosynthetic materials like membrane and filter fabrics.

Sub grade provides the foundation on which the track is constructed. It can be existing natural soil or placed soil. The sub grade must be stiff and have enough bearing strength and stability to avoid excessive settlement. Lack of the required quality will result in an unacceptable disturbance of the track system, and even ballast and sub ballast will not stay in very good condition.

2.1.2 Ballast

Track settlement is generally only treated as a significant problem when it occurs non-uniformly over a short length. Many researchers (Selig and Waters, 1994) concluded that over 50% of the total deformation of railway track originated from the ballast layer. Railway ballast is produced by crushing rock and sieved to get the desired particle size. Its main function is to spread the high loads of passing axles to the subgrade. Thus, ballast materials are required to be hard, durable, angular, and free of dust and dirt. Ideally, ballast used for railway track should have high stiffness, high strength, crushing resistance, chemical resistance and be free from dust. High stiffness can reduce stress to weaker underlying materials, reduce track deflection under load and reduce bending stresses in the rails. The reason for high strength is to reduce build-up of deformation under traffic loading and impart horizontal stability to the track. Besides these functions, ideal ballast should not be affected by dirt from above, soil contamination from below, rainfall, frost and chemical weathering. Additionally, ballast should absorb noise and surplus energy from vibration, meanwhile, allow easy maintenance and be sufficiently workable. The strength of ballast particles is probably the most important factor directly governing ballast degradation, and indirectly settlement and lateral deformation of the railway track. If an individual particle is overstressed, it will fracture and the ballast particles will re-orientate themselves. Fracturing will continue until re-orientation is completed, meaning that there are enough particle contacts for each not to be at too high a stress.

2.1.3 Forces exerted on ballast

There are two main forces which act on ballast. These are the vertical force of the moving train and the “squeezing” force of maintenance tamping. The vertical force is a combination of a static load and a dynamic component superimposed on the static load. The static load is the dead weight of the train and superstructure, while the dynamic component, which is known as the dynamic increment, depends on the train speed and the track condition. The high squeezing force of maintenance tamping has been found to cause significant damage to ballast (Selig & Waters, 1994). Besides these two main forces, ballast is also subjected to lateral and longitudinal forces which are much harder to predict than vertical forces (Selig & Waters, 1994).

The dead wheel load can be taken as the vehicle weight divided by the number of wheels. The static load from the dead weight of the train often ranges from about 53kN for light rail passenger services to as high as 174kN for heavy haul trains in North America (Selig & Waters, 1994). The dynamic increment varies with train section as it depends on track condition, such as rail defects

and track irregularity. The static wheel load distribution was obtained by dividing known individual gross car weights by the corresponding number of wheels, and the dynamic wheel load distribution was measured by strain gauges attached to the rail. The vertical axes of the two figures give the percentage of total number of wheel loads out of 20,000 axles which exceed the load on the horizontal axis. Clearly, the dynamic increment is more noticeable for high vertical wheel loads and is more significant for the mainline track between New York and Washington than the Colorado test track. This is due to the almost perfect track condition for the Colorado test track. It was also noticed that the high dynamic load for the mainline track between New York and Washington occurred at high speeds (Selig & Waters, 1994).

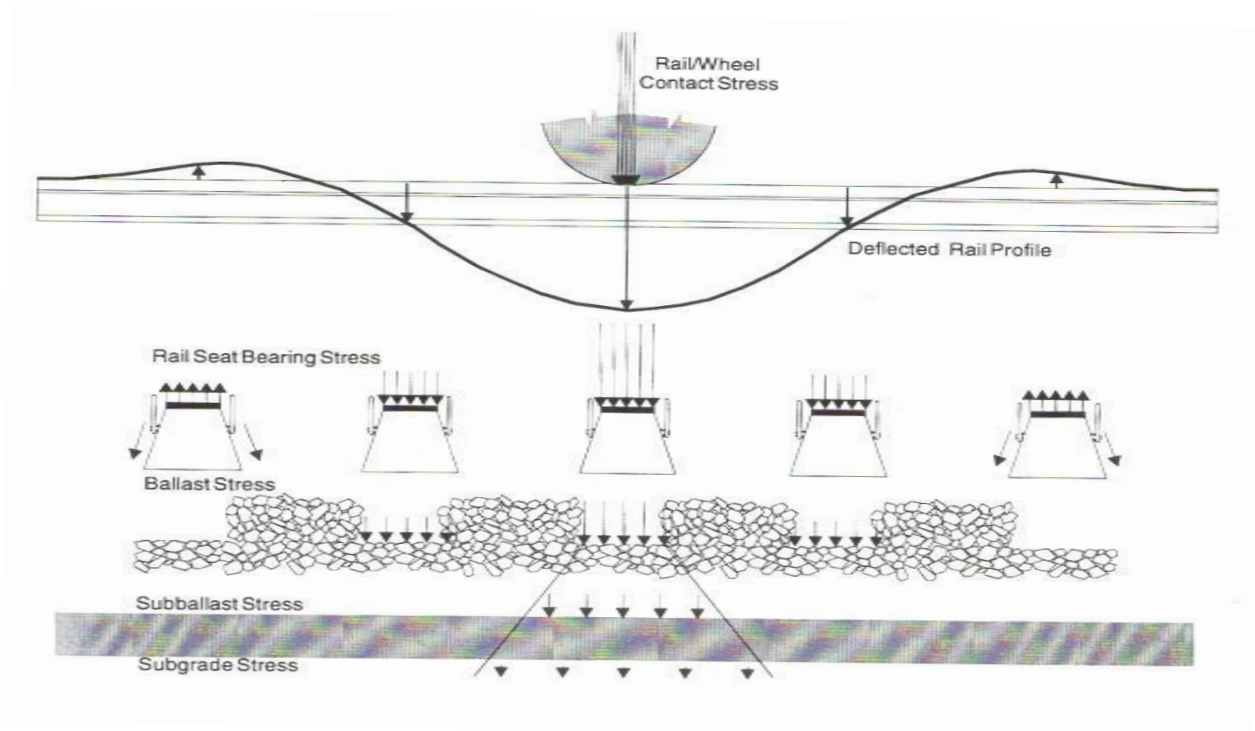


Fig 2.3 Uplift of rails (Selig and Waters, 1994)

The lateral force is the force that acts parallel to the long axis of the sleepers. The principal sources of this type of force are lateral wheel force and buckling reaction force (Selig & Waters, 1994). The lateral wheel force arises from the train reaction to geometry deviations in self-excited hunting motions which result from bogie instability at high speeds, and centrifugal forces in curved tracks. These type of forces are very complex and much harder to predict than vertical forces (Selig & Waters, 1994). The buckling reaction force arises from buckling of rails due to the high longitudinal rail compressive stress which results from rail temperature increase. The

longitudinal force is the force that acts parallel to the rails. The sources of this force are locomotive traction force including force required to accelerate the train, braking force from the locomotive cars, thermal expansion and contraction of rails, and rail wave action (Selig & Waters, 1994).

2.1.4 Behavior of Ballast under different loading conditions

The mechanical behavior of railroad ballast subjected to repeated train passages on ballasted track is under research on many countries of the world. As part of these researches, a study has been made by Tatsuya Ishikawai, Etsuo Sekine, and Seiichi Miura, 2011 on cyclic deformation of granular material subjected to moving wheel Loads. In the research mechanical property of ballast was studied with two sample models along with two types of cyclic loading tests namely single point loading test and moving wheel load test. These tests were carried out with small scale models of ballasted track with use of two samples of ballast differing in mean grain sizes and all components of the track system were modeled to one fifth scale. The model track which simulates section of ballasted track is in the plan strain state with the section assumed to continue infinitely. In their study, with the entire track model components arranged the loading procedure starts and The mechanism of load transfer from the wheel to the track components is indicated in figure 2.4. As a train moves on rail, the load of a moving wheel is distributed in a manner that only half the amount of the total load goes directly to the sleeper and substructure placed underneath.

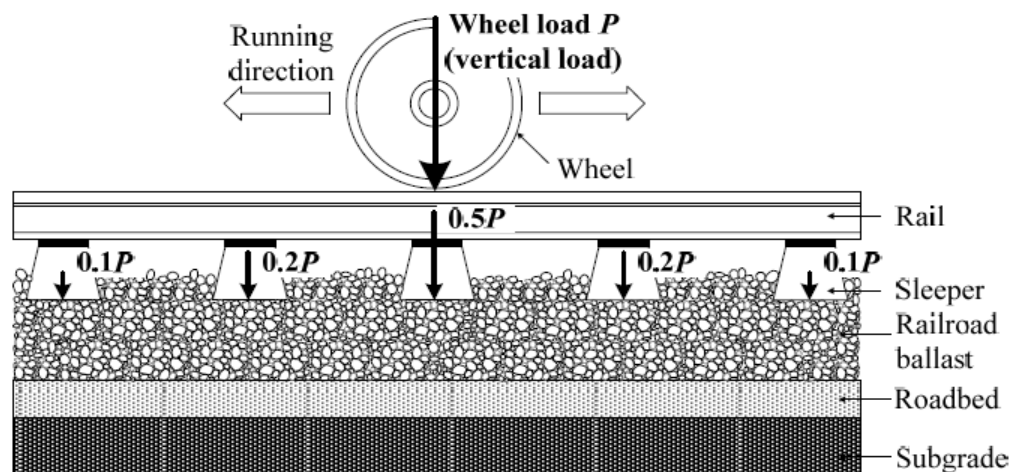


Fig 2.4 Wheel load distribution for ballasted track (Cyclic deformation of Granular Material Subjected to Moving-Wheel Loads, 2011)

At a point of loading the normal component of the rail seat force gradually increases from zero to half of the designated wheel load at the point of contact. However this relation doesn't hold true for the shear component of the wheel force. At a specific location of the wheel load, where the normal component of the wheel load is maximum, the shear load becomes zero. The relation between this two load types is described as follows.

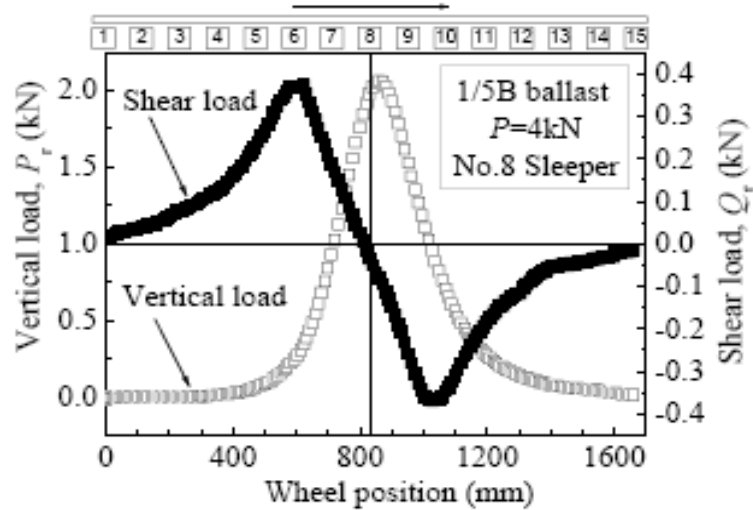


Fig 2.5 Rail seat forces-Wheel position relationship. (Cyclic deformation of Granular Material Subjected to Moving-Wheel Loads, 2011)

In the moving load test, a wheel with a vertical load and a moving pattern is applied and makes a round trip. Cyclic loading was applied on the ballast with a pattern of vertical loading as shown in the figure below.

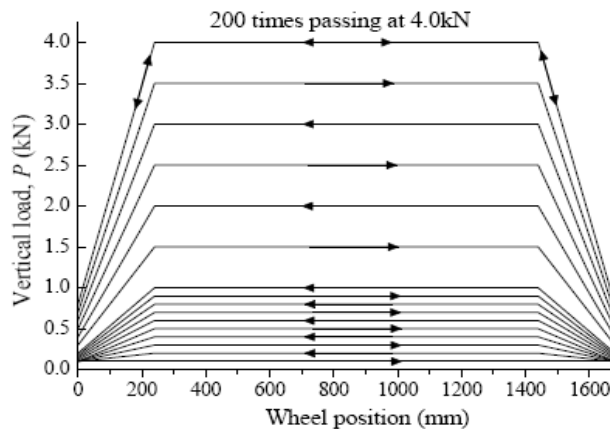


Fig 2.6 Loading pattern of moving wheel loads (Cyclic deformation of Granular Material Subjected to Moving-Wheel Loads, 2011)

After the trip was made, the record of the relationship between the load and displacement showed that at the early stages of the cyclic loading a large displacement is observed by the loading and

unloading force and the plastic deformation increases greatly. But as the loading cycle increases the deformation characteristics of the railroad ballast becomes constant.

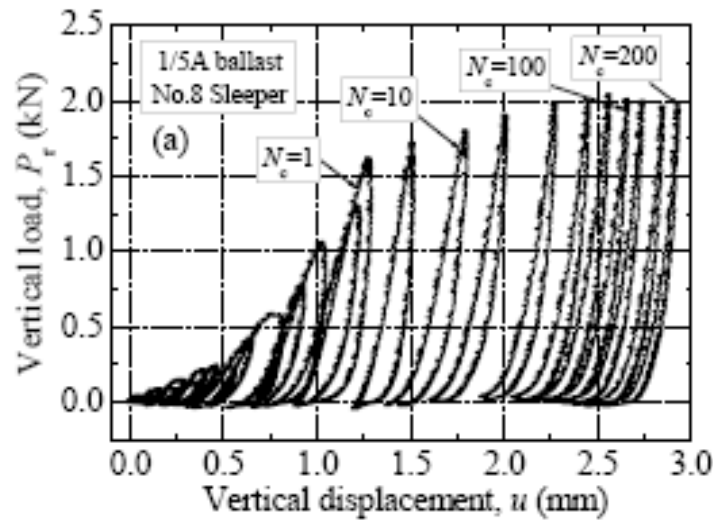


Fig 2.7 Vertical Load-vertical displacement relationships in moving wheel loading tests of the small scale-model ballasted track (Cyclic deformation of Granular Material Subjected to Moving-Wheel Loads, 2011)

Here to evaluate the effects of the moving wheel load on the cyclic deformation on the ballast more quantitatively, the relation after the convergence of the initial settlement between the maximum displacement and number of cycles was approximated by an equation where the y component of the approximate linear equation represents the amount of initial settlement (α) and its slope represents the rate of progressive settlement (β) after the convergence of the initial settlement.

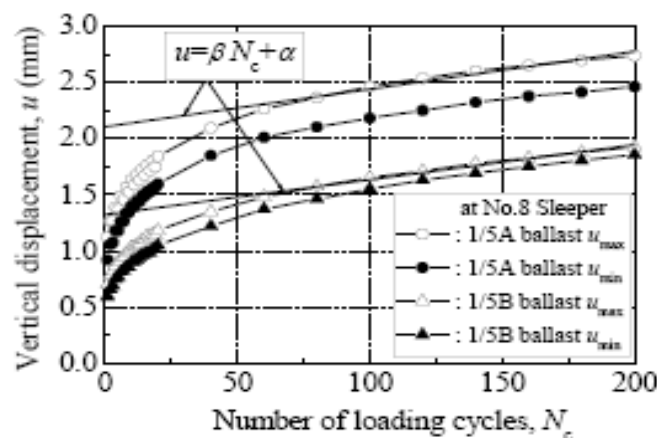


Fig 2.8 Vertical Displacement during cyclic loading in moving loading test of small scale model ballasted track. α , Initial settlement; β , rate of progressive settlement(Cyclic deformation of Granular Material Subjected to Moving-Wheel Loads, 2011)

2.2 Introduction on Differential Settlement

2.2.1 Settlement

Settlement occurs because all soils compress to some degree. Therefore, if a foundation is not on bedrock, it settles. It settles when there is a reduction in the voids in the soil supporting the foundation. Voids contain air and water, and void reduction is caused by the weight of the foundation and its supported structure compressing the soil and reducing the void space. Compression varies according to the makeup of the soil.

Sandy soils contain large granular particles with a relatively small volume of voids. The settlement on sandy soils is usually quick (one to two years) and slight. Clay soils contain smaller particles and relatively more voids than sand. The settlement on clay soils tends to be greater and to occur over a longer period of time than other soils. Clay soils also tend to be somewhat unstable when subjected to periodic drying (shrinking) and wetting (expanding). Some clay soils can change by as much as 50 percent in volume between wet and dry conditions.

Organic soils containing a large amount of organic matter often behave in a manner similar to clay soils. The organic matter shrinks as it dries and expands (like a sponge) when it gets wet.

The increase of stress in soil layers due to the load imposed by various structures at the foundation level will always be accompanied by some strain, which will result in the settlement of the structures. (Barja M. Das, Advanced Soil Mechanics, Third edition, 2008)

If the structure as a whole settles uniformly into the ground there will not be any detrimental effect on the structure as such. The only effect it can have is on the service lines, such as water and sanitary pipe connections, telephone and electric cables etc. which can break if the settlement is considerable. Such uniform settlement is possible only if the subsoil is homogeneous and the load distribution is uniform. However, the differential settlement if it exceeds the permissible limits will have a devastating effect on the structure. (Kira Holtzendorff, Uif Gerstberger, Technical University Berlin, Predicting Settlements of Ballasted Tracks due to Voided Sleeper)

2.2.2 Track Settlement

When a train, be it a passenger or freight train, is moving on a railway track, it induces a downward force on the track it is travelling on. This force exerted on the track by the weight of a moving train will be then transferred to different components of the track. The weight of the train in the case of a ballasted track will be transferred from the rails to the ballast and sub ballast (if the given situation requires it) before it reaches to the final sub ground level where it will be

distributed to uniformly. As a track is loaded by a train the ballast and the sub grade may experience non elastic deformations. When the load goes off, the track may not exactly return to the original height but to a position very close to where it was in the beginning. After many train passages the small non elastic deformations will add up and the track will get new position.

When exposed to repeated traffic loading, a track will settle due to the permanent deformation in the ballast and underlying soil. After having been used some time, the track will not be so straight and at so good level as it was when it was new. The settlement is caused by the repeated traffic loading and the severity of the settlement depends on the quality and the behavior of the ballast, the sub-ballast, and the sub grade.

Settlement of ballasted track occurs in two major phases:

1. Directly after tamping the settlement is relatively fast until the gaps between the ballast particles have been reduced and the ballast is densified.
2. The second phase of settlement is slower and there is a more or less linear relationship between settlement and load.

The second phase of settlement is caused by several basic mechanisms of ballast and sub grade behavior:

- There is continued (after the first phase) volume reduction, i.e. densification caused by particle rearrangement produced by repeated train loading.
- Sub-ballast and/or sub grade penetration into ballast voids takes place. This causes the ballast to sink into the sub-ballast and sub grade.
- There is volume reduction caused by particle breakdown from train loading or environmental factors; i.e. ballast particles may fracture (divide into two or more pieces) due to the loading.
- There is volume reduction caused by abrasive wear. A particle may diminish in volume due to abrasive wear at points in contact with other particles; i.e. originally cornered stones become rounded, thus occupying less space.
- Inelastic recovery on unloading or stress removal takes place. Due to micro-slip between ballast particles at loading, all deformations will not be fully recovered upon unloading. Permanent deformation is a function of both stress history and stress state.
- Movement of ballast and sub grade particles away from under the sleepers causes the sleepers to sink into the ballast/sub grade.

- Lateral, and possibly also longitudinal (in the rail direction), movement of sleepers causes the ballast beneath the sleepers to be ‘pushed away’, and the sleepers will sink deeper into the ballast.

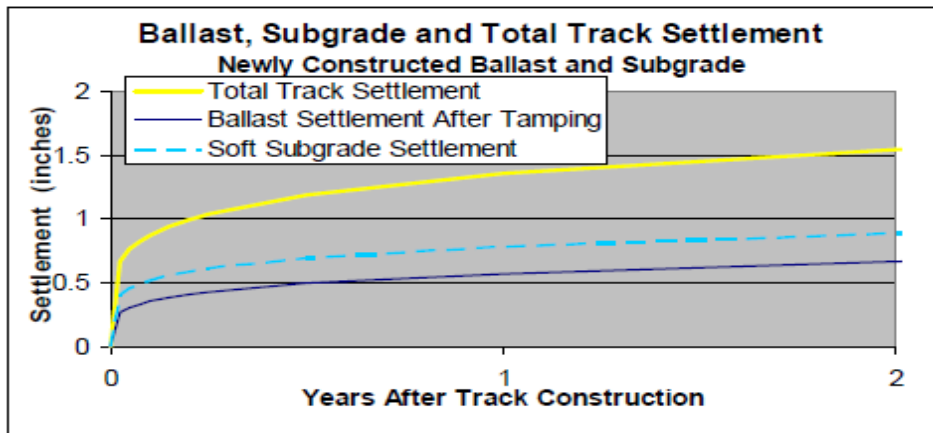


Fig 2.9 Ballast and Sub grade Contributions to Total Track Settlement for New Construction

However, the opposite trend is true with ballast settlement exceeding that of the sub grade in the initial years following tamping for the more common case where ballast and sub grade have been compacted by several years of traffic

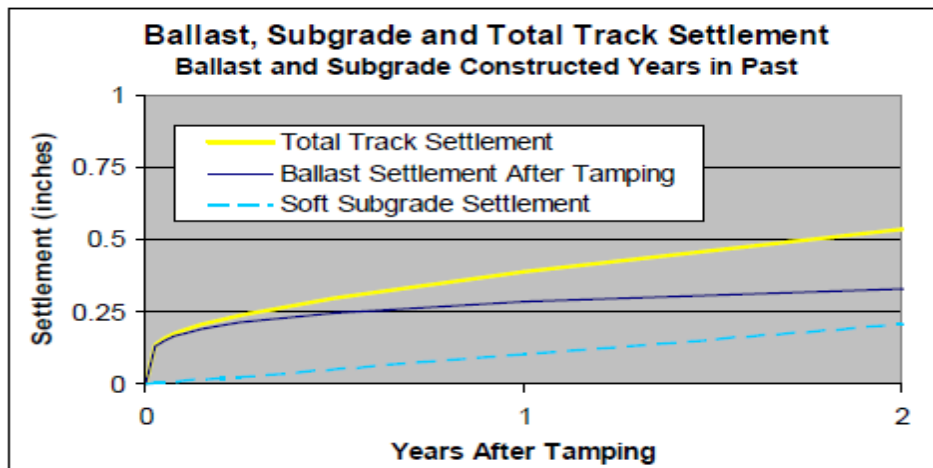


Fig 2.10 Ballast and Sub grade Contributions to total Track Settlement for old construction

After the built-in of the ballast layer and the following stabilizing procedure, the ballast can be considered as a stabilized material where the particles are locked against each other. One can distinguish between two basic mechanisms - compaction and particle rearrangement. Initially settlement occurs due to a compaction process during the first load cycles. However, after a precise built-in procedure one can expect this plastic ballast deformation to be minor. The second effect of particle slip (lateral flow) can occur during the whole time of operation. Here the layer becomes destabilized by exceeding certain levels of stress or vibrations induced by the passing

train. The range of slip strongly depends on the horizontal stress that had been built up earlier, but gradually diminishes during the vibration impact. The lower the horizontal stress, the more likely it is that the particles will slip against each other. [3]

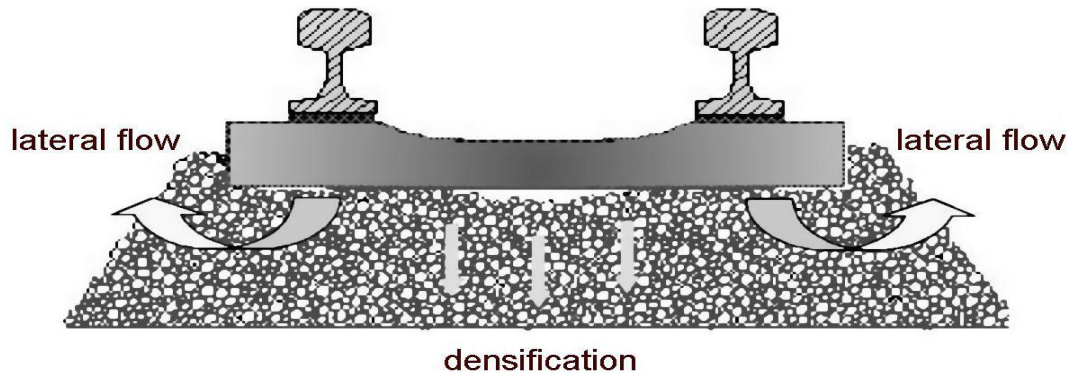


Fig 2.11 Settlement mechanism in the ballast layer

2.2.3 Parameters influencing ballast settlement

Deviatoric stress

For a certain level of the deviatoric stress, the friction resistance at the contact points between the ballast particles will be exceeded. Consequently, the particles start to move and rotate against each other. A tendency of horizontal spreading of the ballast layer can be observed. This effect occurs when the applied deviatoric stress exceeds a limiting value that is found in the vicinity of the stress ratio at failure of the ballast fabric.

Vibrations

Initially, the degree of the horizontal stress below the sleeper is relatively high as the layer is confined from the cribs and shoulders and the material adjacent to the loaded area. When dynamically loaded by the passing trains, the stress decreases due to the vibrations and the particles start to flow in lateral direction.

Degradation

Particle abrasion and breakage is caused by particle slip, tamping actions and from different environmental sources. The voids of fouled ballast become progressively filled with fine particles. As a consequence, the damping degree of the material increases which in turn leads to

an increased radial receptance of the material. Hence the stability of the ballast fabric decreases and the particles start to spread horizontally.

Sub grade stiffness

The stiffness of the underling sub grade clearly affects the quantity of ballast settlement. The more the sub grade deforms elastically the more the ballast particles are able to move into different directions. (V.N.S Murthy, Geotechnical Engineering: Principles and Practices of Soil Mechanics & Foundation Engineering)

2.3 Differential Track Settlement

The mechanism by which track geometry generally deteriorates due to repeated loading from passing traffic track is very complex. If all points on the track were to settle by the same amount, no irregularities in the vertical space curve would develop. However these settlements are generally far from uniform due to variations in the track support and wheel load distribution. These deviations cause differential settlement due to plastic deformation of the support in the wave length experienced by the rolling stock.

A railway track settlement profile, especially in certain areas of special interest, has to be thoroughly studied and analyzed in order for safe and economic operation of the transportation mechanism and preservation of track quality which is one of the main concerns for railways infrastructures and passenger comfort.

2.3.1 Causes of differential Track Settlement

2.3.1.1 Dynamic Vehicle- Track Interaction

Deterioration of the vertical and lateral geometry of the track takes place due to settlement and disturbance of the ballast and sub grade, predominantly as a result of traffic. Uniform settlement or uniform shift in the lateral case would not in itself cause deterioration in the quality of the track geometry, but it is the differential movements which result in a worsening of passenger ride and an increase in dynamic loads. Differential displacements can occur due to the general random nature of the settlement process and also due to the lack of straightness of the rails, but the major contributor to the problem is the vehicle dynamic loads. (Dynamic Analysis of railway Vehicle/Track interaction Forces, Geoffrey A. hunt, 1986)

Dynamic vehicle/track forces from a train travelling over a long continuous wave in vertical track profile can compress the ballast preferentially in the troughs, thus making the wave worse.

An existing wave excites the vehicle motion which in turn generates forces to accentuate the wave; the accentuated wave then excites the next passing vehicle more strongly and the cycle starts again.

The main source of input forces to the vehicle of course is the track. Ideally this would be a flat level surface having straight parallel rails but clearly this cannot be achieved in practice. Dynamic forces therefore result between wheel and rail both vertically and laterally. The forces which occur have a number of undesirable effects, namely loss of track geometry as a result of settlement, damage to track components due to overstressing and fatigue and, particularly at the higher frequencies, ground borne vibration and noise. (Dynamic Analysis of railway Vehicle/Track interaction Forces, Geoffrey A. hunt, 1986)

The irregularities in the track which cause the dynamic forces come from a variety of sources. The sources of track irregularities can be summarized as follows: -

i) Joints and welds: The fish plated rail joint has long been considered one of the main geometric faults in the rail surface. As a result of repeated loading and unloading the joint begins to wear, this begins a cycle of increasing dynamic load, differential ballast settlement at the joint and more joint wear. A large dip therefore results in the track with an angular discontinuity at the joint. The introduction of continuously welded rail has resulted in an improvement of the geometry where rails are joined together, however welds still represent a significant source of geometric error, particularly where a poor weld has been made or the top surface has been badly ground when finishing off the- weld. Welds and joints also present discrete irregularities laterally if poorly aligned.

ii) Random roughness: This in itself can come from a variety of sources; at the shorter wavelengths irregularities in the shape of the rail are important. These obviously come from the manufacturing process and from damage in handling. At the longer wavelengths the track vertical profile is dominated more by the underlying ballast profile. This is difficult to modify permanently by mechanical means because the ballast tends to settle at a greater rate the more it is lifted when tamping. For this reason the periodic shape of jointed track can reappear in track which is re-railed with continuously welded rail even if the welds do not coincide with old joint positions.

iii) Variations in track parameters: Large dynamic forces can occur at changes in track support conditions, for instance where a single sleeper is poorly supported or where a change occurs in the underlying foundation conditions. These generally apply more to the vertical case, however a situation where this applies laterally is given below.

iv) Track Structures: Bridges represent a significant transition when negotiated by rail vehicles. Another important structure, however, is the track switch or turnout. This provides both an unavoidable discrete irregularity where the switch rail joins the through straight rail and also significant changes in lateral stiffness through the switch due to the varying construction. This change of stiffness also applies to a certain extent vertically.

The point where the two rails of the turnout cross obliquely is called the crossing. A gap is obviously necessary at this point to allow the wheel flanges to pass through, which can result in large vertical and lateral forces.

All of the above cases represent inputs to the track which cause dynamic forces. It is known that dynamic forces cause progressive deterioration of the geometry of the track and therefore it is anticipated that the irregularities described could be made to grow by the forces they produce. (Dynamic Analysis of railway Vehicle/Track interaction Forces, Geoffrey A. hunt, 1986)

2.3.1.2 Track Stiffness Variation

Moving along a regular track a train will generate vertical dynamic axle loads (super imposed on the moving static load owing to vertical weight) as a result of variations in the vertical track profile and the track foundation stiffness. If the foundation stiffness is uniform and dynamic loads are not significant as might be the case for a solely moving train, then the additional deflection due to an axle load is uniform at all points along the track, in other words the loaded track geometry is the same as the unloaded geometry. As a train moves onto a bridges abutment the effects of varying geometry and foundation stiffness are usually significant.

Track stiffness is a significant parameter from the aspect of designing, construction and maintenance of the railway superstructure and substructure. This parameter represents the basis for calculating stresses in the elements of the track and track foundation. Stiffly leant rails have lesser elastic deflections and bending stresses in the rail, while the pressure force transmitted from the rail to the sleeper and further to the ballast and substructure is higher.

Spatially varying track stiffness is one of the basic causes of differential track settlement, which has primary influence on the track geometry deterioration. The basic causes of the occurrence of spatially varying track stiffness are the construction change of the superstructure and substructure along the line, variable ballast thickness, variable blanket layer thickness and characteristics of the material that the embankment was made of, moisture content, geological characteristics of the subsoil. Uneven track stiffness along the track is the usual problem which has been explored within numerous research projects. Changes in track stiffness will cause variations in the train/track interaction forces. The force variations give rise to track degradation such as track differential settlement due to permanent deformation of the ballast and in the underlying structure. The settlement is caused by the repeated loading and the severity of the settlement depends on the quality and the behavior of the ballast, substructure, and foundation.

Transition Sections

Track transition regions are locations where a railway track exhibits abrupt changes in vertical stiffness. These usually occur where slab track changes to ballasted track, at the abutments of open deck bridges, where a concrete tie track changes to a wooden tie track, at the ends of a tunnel, at highway grade crossings and at locations where rigid culverts are placed close to the bottom of the ties in a ballasted track. Transition regions require frequent maintenance. When neglected, the track geometry will deteriorate at an accelerated rate. This may lead to pumping ballast, swinging or hanging cross ties, permanent rail deformations, worn track components, and deteriorating rail surface and gauge. These in turn may create a potential for a derailment. As train speeds increase, problems resulting from track transitions are exaggerated

Bridge Approaches

As normally built, track on a bridge is relatively stiff, being supported by a rigid bridge structure. Track off a bridge is supported by an earth subgrade, which permits more deflection when subjected to the same load. As a loaded wheel rolls over the end of a bridge and passes from the stiffer track on the bridge to the less stiff track off the bridge, an abrupt difference in vertical deflection occurs, which creates a bump in the track—a track surface deviation. As is well known and documented, track surface deviations cause dynamic loads or impacts when trains pass over them, and those higher loads increase track settlement.

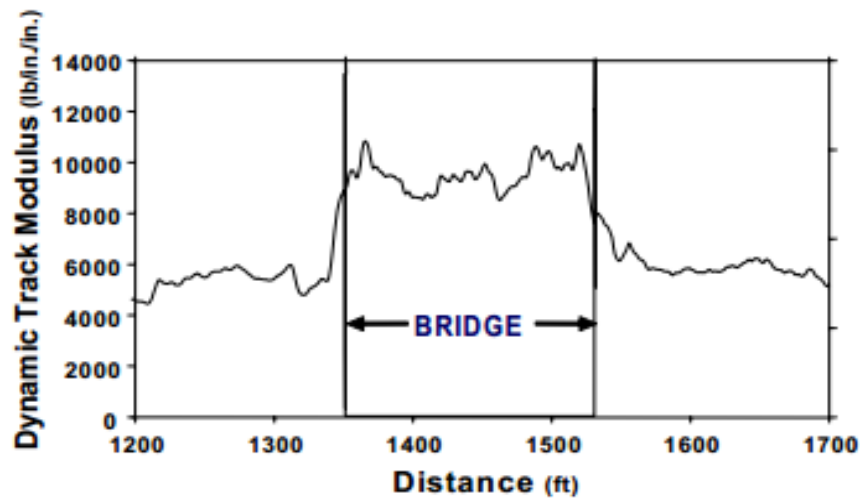


Fig 2.12 Track Stiffness Variation along a bridge transition zone (Plotkin & Davis,2008).

Switches and Turnouts

Turnouts enable a train to be switched from one track to another. When a train traverses the turnout, the wheels change from rolling on one rail to rolling on another at the crossing. Under perfect conditions, the wheels traverse smoothly over the rail discontinuity and the magnitude of the wheel/rail contact force does not increase very much. In reality, however, irregularities on the wheels and the rails make transition at the crossing far from perfect. This will cause a large increase in the wheel rail contact force, which may cause plastic deformations wear and or crack growth in the crossing as well as in the will. Cracks can arise directly or through fatigue. The parameters having the largest effect on the magnitude of the impact load are the speed of the train, the geometry of the crossing and wheel and the axle load.

A switch contains several irregularities both in stiffness and in inertia; the bending stiffness of the switch rail differs from that of the stock rail, the sleepers have different lengths and distances, the crossing (the frog) is both stiffer (in bending) and has a larger mass than the surrounding rails, and so on.

Chapter 3 Methodology

In this section of the research detailed approach used to carry out the study will be briefly discussed. Here the steps followed by which the final objective of the research is obtained will be discussed. Along with the techniques used to carry out the investigations, the assumptions and simplifications used to simulate the exact site condition will also be discussed accordingly.

First the analysis of the differential settlement of the Addis Ababa Light Rail transit track system is conducted in the longitudinal direction (two dimensional analyses). This analysis will take one selected sample location from the North to South Line. These sample location will be selected after a visual inspection is conducted throughout the entire sections and a section of irregular stiffness which potentially may lead to differential settlement is identified and labeled. The sample locations will be selected based on their tendency to be exposed to the differential settlement due to one of the many reasons described as a cause for this condition in the previous section of the study. In other words, areas suitable for this condition such areas where track stiffness variation is observed will be of primary concern. After this, two dimensional analysis of the longitudinal track geometry will be conducted as will be described later in the general procedure. According to the parameters described above, one specific location on the North to South route at station KM 13+050.00, the railroad alignment was found to pass perpendicular to a local river and thus needed to have a culvert section joining it. At this point the stiffness of the alignment varies as the railway crosses this section and thus was selected as a target section for study.

After this sample location is identified, the general method of approach for the analysis is summarized and described as follows

In the first stage parameters and associated values such as stiffness of the track and its foundation, Static Wheel load, approach parameters such as Ballast material quality and thickness, Tie Type and Spacing, Sub grade quality and depth, Rail weight, at the selected sample locations was collected and fed to the analysis software as an input. Here depending on the analysis depth, it may need additional or less of the material properties stated above.

In the second stage using the above mentioned initial conditions and initial vertical track profile at selected locations, the track stiffness variations and the different types of loads fed to the computer program, modeling process commences. Here the methodology for predicting track deformation starts by modeling of railroad track containing rail, sleepers, ballast and an element to model the track settlement. The model is loaded by the weight of the track structure (rail and sleepers) and by a moving mass subjected to a constant force P from the car body. For this study, the longitudinal rail profile selected is positioned at the center of one of the pair of rails that run parallel. With regard to this, to simplify and study the behavior of the track easily, an assumption has also been made to take only one wheel of the two axle bogie set. Along with that, the face of the sleeper and the rest of the track structure including the ballast, sub grade and backfill material; have been selected in the longitudinal section of the railway track.

Here determining the stress at the ballast layer which composes of initial vertical stresses due to the weight of the superstructure and the soil as well as the imposed wheel loads comes at the first stage. With regard to this, in order to fully understand the phenomenon and represent the actual loading condition the dynamic loading part of a moving train, a dynamic train track interaction model where the vertical dynamic wheel/rail interaction forces are calculated will be used in order to determine the loading transmitted to the ballast through each sleeper of the track.

Third the stress created on the ballast due to the vertical loading is determined; the next step will be to determine the vertical deformation that would be expected to develop under the applied loads. Using the applied load accumulation on the ballast particle, the permanent axial deformation on the ballast will be obtained. Here the law governing the settlement of the ballast will be based on the assumption that the settlement of the track is directly proportional to the logarithmic of the total tonnage moving over the section.

Once the axial deformation is computed for the whole model two specific points from different sections will be selected to represent the general deformation behavior of the normal and section with a different track stiffness parameter. Using these two points the axial deformation for selected no of cycles will be studied. Here the number of cycles will be selected based on the modeling complexity and the amount of time it takes to finalize the analysis. Accordingly, after the selected number of cycle is conducted a general regression analysis equation will be

developed to estimate the total deformation of the ballast after N number of cycle for the same section.

After the estimation regression is computed, based on the computation and results found from the analysis an effort to make a recommendation for maintenance time of the ballast time will be made.

Chapter 4 Analysis and Discussion

This study aims at finding the performance capacity of a ballasted railway track at transition zones with the help ABAQUS software used for simulating granular material deformation behavior. The analysis of this kind will be conducted with the help of Finite element method which is one of the most versatile numerical techniques applied for engineering analysis, as it enables a good approximation to be made even when a system exhibits non-linear material behavior. It can be applied to solve problems in solid mechanics, fluid mechanics, heat transfer and vibrations. In such analysis techniques, the model domain is divided into a finite number of elements. In solid models, displacements in each element are directly related to the nodal displacements, which connect each element. The nodal displacements are then related to the strains and the stresses in the elements. Finite element method tries to arrive at the nodal displacements, so that the stresses are in equilibrium with the applied loads. Once the equations are solved, the actual strains and stresses in all the elements can be found.

Here in this research, onsite track components arrangement will be modeled and analyzed to determine how the track system behave when a given load is applied to it.

4.1 Modeling of Track

As railway ballast typically behaves nonlinearly under wheel loading, making fundamental simulation of railway ballast simulation would be a very difficult and complex task.

Currently, the analysis of track structures usually follows one of two paths:

- (1) The track structure is represented very simply, e.g., a beam on an elastic foundation wherein the substructure is represented as a spring-damper system (the damped Winkler foundation).
- (2) The track structure is modeled in detail by using a finite-element model.

In the first case, the system is represented so that contributions from individual components such as ballast, sub grade and sleeper bending are not sufficiently detailed. However, interrelating the components of the track structure, to properly represent its complex interactions, can help determine the net effect of traffic loads on the stresses, strains and deformations and thus for this research the latter technique is used to get an in-depth understanding of the mechanics of ballast behavior near areas of interest.

Sectional and Material Property Definitions

The evaluation of track performance due to traffic loads requires the ability to predict realistic pressure distributions at interfaces between the sleeper and the ballast and between the ballast and the sub grade. Thus, theoretical models must include the effects track parameters such as rail dimensions, sleeper spacing, rail/fastener stiffness, ballast depth, and sub grade and roadbed material properties. Unfortunately here, the in depth material characteristics of the components of the track system could not have been gathered due to limitations and restriction faced when collecting the data from the concerned Government/private bodies involved in the construction and supervision of the construction work. However the basic parameters have been collected and others that were not available, have been collected from the standard and literatures that were found to be a fit for the research process. The data used for the analysis of this research have been presented in the annex section of the research. At the beginning of the modeling procedure all track component parts were created individually to represent the exact on site condition. These parts were created with a symmetrical arrangement in order to reduce resource use and analysis time. The parts dimension are, as much as possible close to the actual components dimensions except at certain locations where using the exact dimension of track component creates unnecessary complications in the analysis process such as distortions in meshing assignments. In such cases assumptions have been made in order to simplify the modeling and analysis process to the maximum possible simplicity without losing grip of the reality.

	Density	Young Modulus	Poisson's Ratio	Depth
Reinforced Concrete Slab Culvert	2,500 kg/m ³	31 GPa	0.2	0.2m
(Source: Ethiopian Buildings Code of Standard)				
Bituminous Concrete , HMA Bituminous Concrete Water Proof layer	2,322 kg/m ³	5.5 GPa	0.3	0.05m
(Source: Design of Track Transitions, Transportation Technology Center, Inc. (TTCI) in Pueblo, Colorado.)				
Hard Plastic Clay Sub grade Soil Material (Hard Plastic Clay)	2,000 kg/m ³	75 MPa	0.2	4.5m
(Source: APPC Appendix III Soil Parameters)				
Crushed Stone Plain Fill	1,600 kg/m ³	400 MPa	0.35	1 m
(Source: Pavement materials Typical Values)				
Rock Backfill	2,650 kg/m ³	35 GPa	0.25	3.37m

(Source: Mechanics of Material” by James M. Gere, Stephen P. Timoshenko, 1997)				
BALLAST	1,540 kg/m ³	130 MPa	0.3	0.4m
Virtual uniaxial stress-strain curve for hardening simulation				
	Stress (Pa)	Strain	Flow stress Ratio	0.78
	7,700	0.005	Dilatancy angle	27
	20,000	0.008	Friction angle	55
	25,000	0.02		
	36,000	0.04		
	39,000	0.06		
	42,000	0.09		
	44,000	0.15		
(Source: Prediction of permanent deformation in a railway track. Thesis submitted to the University of Nottingham for the degree of Doctor of Philosophy, April 2009)				

Table 4.1 Material Properties of Track Components

Assembling Track Components

After creating and defining individual track components separately, the next task will be to assemble them in a manner that best fits or suits the actual site condition. Accordingly a nearly eleven meter sample was selected at given location. In the modeling process a symmetry concept was used and all the components of the track along with the adjacent slab culvert structure were brought up to a single instance and were all arranged according to their position in order. Here in order to place all elements of the track one fixed datum was used which started at the beginning of the center line of the rail. After a datum point was created all components were placed in reference from distance from this starting point. After this, in order to define interaction between these components, surfaces for every component interacting with another, was created. Here the rail in the track system is designed as a simple beam that is pinned to the sleepers underneath. The interaction between the rail and the sleeper is that is represented by rail fasteners is the modeled by a spring and dashpots with a given damping and stiffness parameters. The interaction between the top ballast layer and the bottom sleeper surface, Asphalt and ballast layer, Asphalt and Top layer of sub grade and Ballast layer and precast slab top cover surface is represented by a hard contact with a specified figure of friction coefficient.

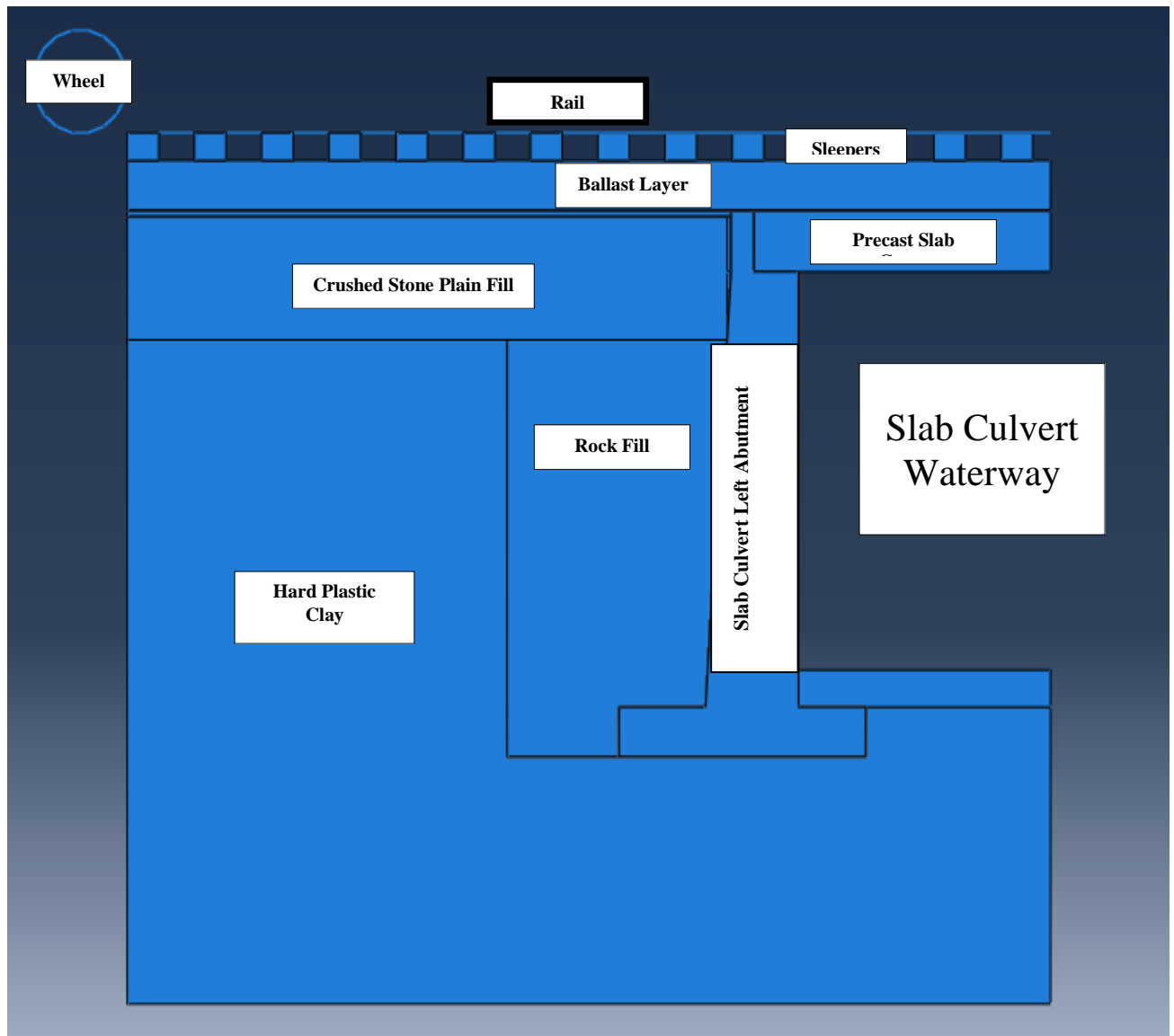


Fig 4.1 Symmetrical Assembled Track Cross Sectional View

Loading

After the interactions of the track components have been assigned, the next step is to assign the loading condition of the system. But before the loading condition is defined the boundary condition for the whole system has to be laid as a foundation for the loading system to work effectively. Therefore the boundary condition for all components exposed to both edges of the system was assigned according to the movement limitations they are exposed to in the actual condition. Here while nearly all components were assigned a stationary boundary condition one (the wheel) was given a moving boundary condition so that it would simulate an actual train passing on the track. With regard to this, an assumption was made to use a single wheel for the analysis. The reason why this assumption was made was to simplify the complicated loading

pattern of a moving train. Here, with the use of a single wheel load, it is possible to get an insight of the behavior of the granular material with a simplified approach.

After the boundary conditions have been assigned for the moving and stationary and restrained part of the track, the loading follows. Due to limitation faced in the modeling environment while simulating an actual train movement, here like the previous sections too, an assumption was made to move the same amount of load go back and forth to depict repeated train movements at a single location. At this stage the initial interest was to move the load cyclically for numerous counts to study the deformation character. However the machine requirement of the software was so unrealistically high, even with the highest memory capacity and multiple core processors of machines, the repetitions couldn't go any further than 100 cycles. Accordingly the data for 100 load cycles were gathered and linear relationship between deformation and number of load cycles were developed in order to estimate deformations values for high load cycles.

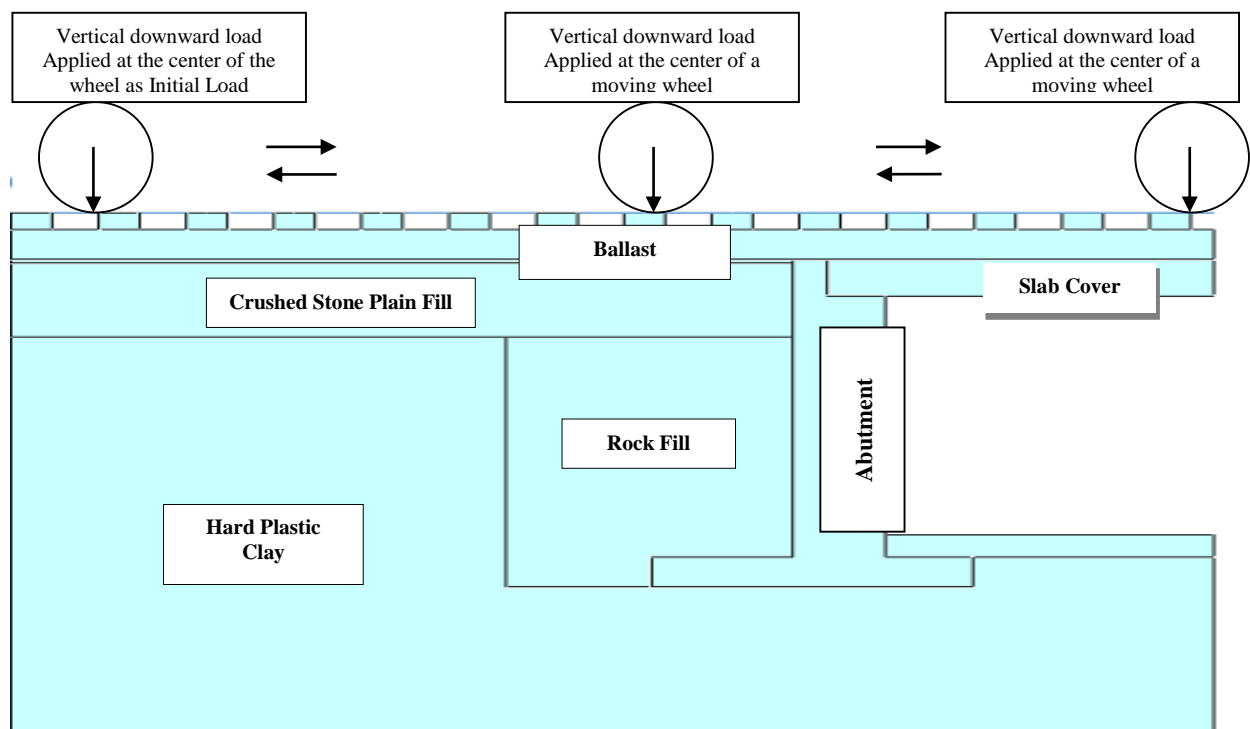


Fig 4.2 Loading pattern

4.2 Analysis

The analysis part of this study focus on finding the deformational values of the ballast layer at two different sections: the section of relatively higher stiffness and that of lower stiffness. For the purpose of this, two points from both sections are selected to show the different deformational characteristics of the two sections. Here after the loads have been applied and the corresponding

analysis time has been assigned for the program to compute equilibrium equations and generate solutions in the form of displacement values, the results of the selected two points are deeply investigated and analyzed. The analysis majorly revolves around the displacement of certain nodes on selected locations. These nodal displacements vary as time and corresponding wheel loading varies. The maximum nodal displacements are obtained when the wheel load is directly upon them. At this point the nodes displacement attains their highest value but bounces elastically a certain distance back as the wheel load moves away. Here there is a difference between the two deformations is called the plastic deformation of the ballast layer. So with this concept in mind, it is easier to calculate the total cumulative displacement of the layer.

In the analysis of results, the displacement in the y direction of two selected nodes are recorded and evaluated with respect to each other. The nodal displacement depicts the actual settlement behavior of the track and is important for estimating the safe operation time limit before differential settlement between the two sections becomes much of a problem.

Sample Location 1 (Less stiff Side of the Track)

This sample node is selected to represent the deformation pattern of a less stiff section of the ballasted railway track. The node selection was made directly from the bottom of the respective sleeper to carefully examine the load to displacement relationship between train load and the node movement. A single load test was applied to the model to see the displacement character of the ballast layer and the reaction at the specific node is depicted as follows.

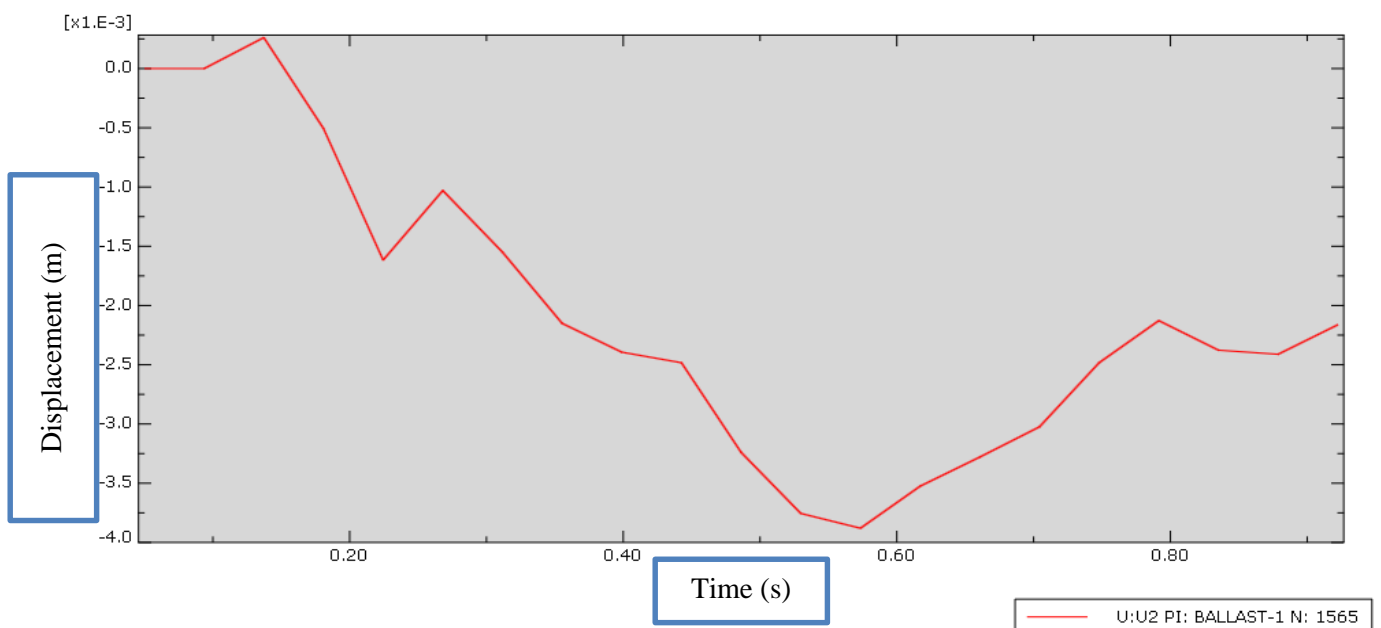


Fig 4.3 Time (Wheel position) versus Displacement graph for sample node (1565)

As it can be observed from the graph, as the wheel load approaches the node, its displacement value increases to a final point where the load have its maximum effect on the node and it displaces to its maximum value. However as the load moves away the deformation doesn't return to its original place i.e after attaining u_{max} the node recovers part of the deformation and goes back to u_{min} .

Sample Location 2 (More Stiff Side of the Track)

Here, similar to the first point of interest, the y direction displacement of the node has been recorded and displayed below. At this section, the maximum displacement of the node, unlike the one on the other side, is relatively small. As the supporting section to this ballast layer is relatively stiffer than the one on the opposite section, the overall displacement of this section is expected to have smaller values than the deformation values obtain for the sub grade section. The values of the displacement

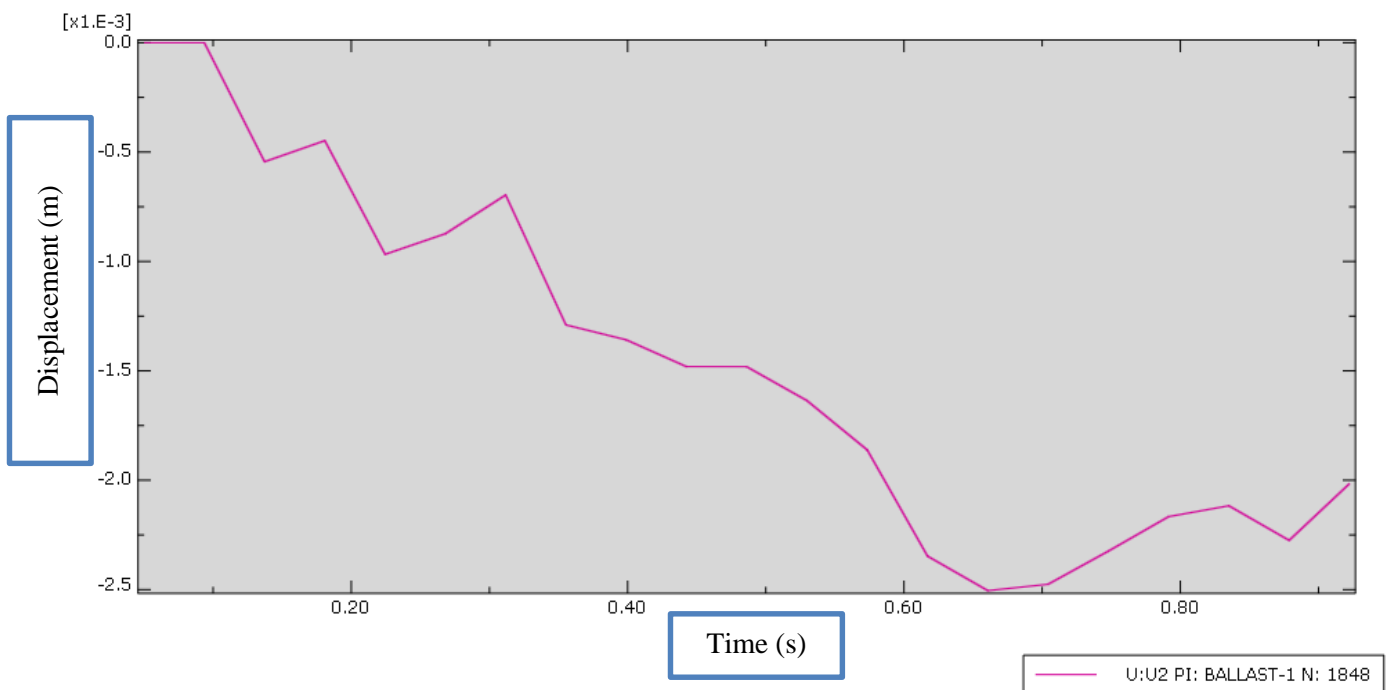


Fig 4.4 Time (Wheel position) versus Displacement graph for sample node (1848)

This is due to the stiffness differences exhibited by the two sections. In addition to the deformation differences between the two sections, the behavior of recoverable amount of displacement (strain) also differs.

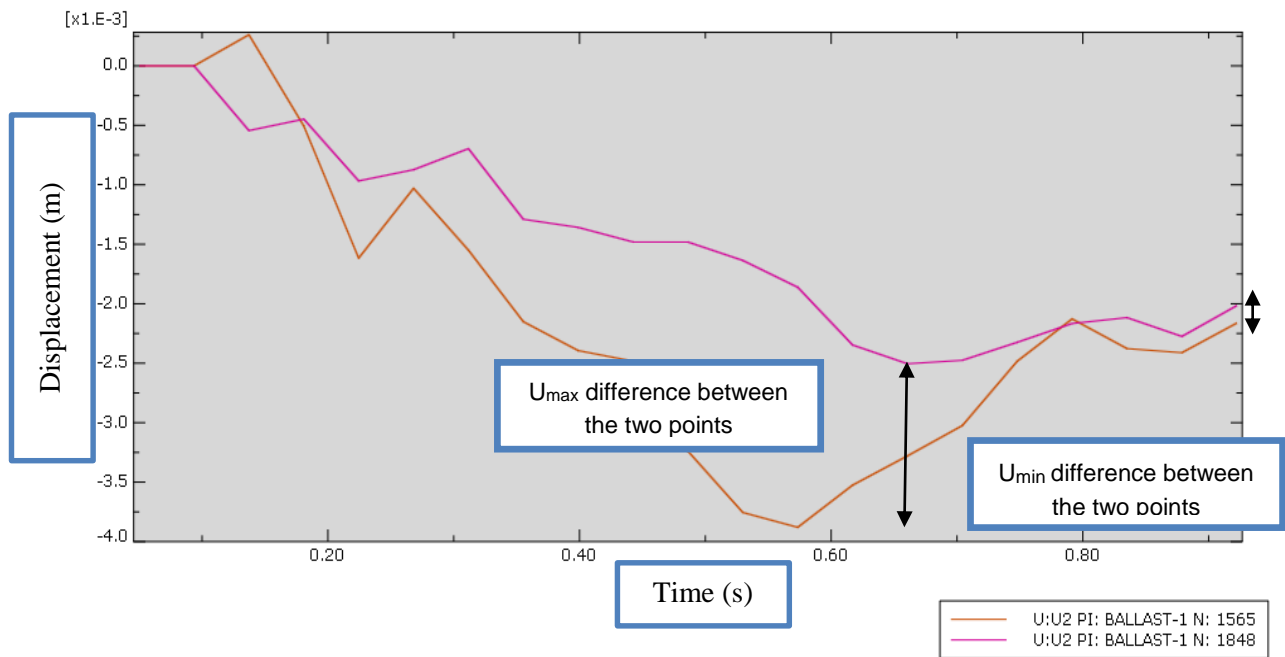


Fig 4.5 Initial Time (Wheel position) versus Displacement graph for sample nodes (1565 & 1848)

Single and Multiple Loading Conditions

The behavior of ballast placed in two different sections differs with the loading condition too. The deformation goes on to the second stage of loading with its u_{\min} as the base for the initial position for the second loading. For this study the second loading will be applied in the reverse direction with the same velocity and load magnitude as it was in the first case. With such approach at the early stages of cyclic loading, a large displacement is observed by a loading curve and an unloading curve, and the permanent settlement increases greatly. However, with the increment of loading cycles, the magnitude of the deformation value decreases and the characteristics of the railroad ballast become elastic and constant.

With just a single loading instance it will be hard to distinguish between the differential settlement behaviors of the transition section since the recovered displacements doesn't majorly vary. However as the number of loading cycles increase the difference between the two points becomes much clearer and the deformational gap in between will be widened.

Note that the minimum displacement attained at the end of loading (u_{\min}) represents the cumulative permanent settlement. Both the maximum displacement (u_{\max}) and the minimum displacement (u_{\min}) increase slowly with increasing number of cycles after the exponential increment at the early stages of cyclic loading, and their rates of increase decrease with the

increment of number of cycles. Because of densification, the displacement amplitude ($u_{\max} - u_{\min}$), when compared to the initial value, gradually becomes uniform as the loading cycle increases, which indicates that the increase of displacement comes from the cumulative permanent settlement of the railroad ballast.

4.3 Results and Discussion

After the 100 cycles loads have been applied to the model, the values of displacement of the selected nodes have been obtained. These values are time dependant and change with respect to the position of the wheel load. The values have been prepared in pre arranged intervals of frames and represent the actual displacement of a single ballast particle inside the ballast layer. The magnitudes of these displacements at every frame the analysis, for all repeated loading, versus time has been extracted from the software and has been presented in APPENDIX-II.

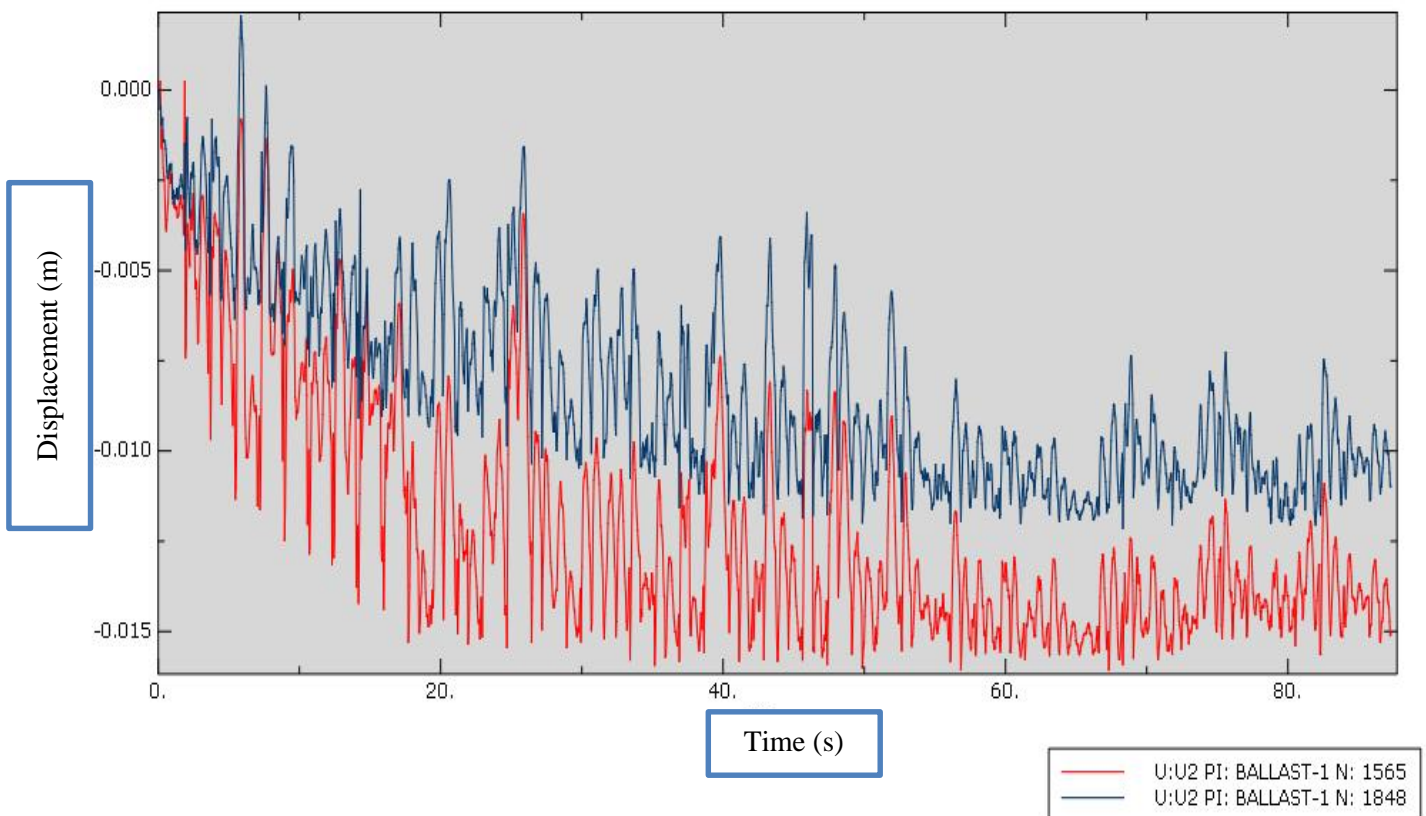


Fig 4.6 100 Nc Number of Cycle Time (Wheel position) versus Displacement graph for sample nodes (1565 & 1848)

With this regard, after the 100 cycle loads are applied to the model, in order to evaluate the effects of the moving-wheel loads on cyclic plastic deformation of railroad ballast quantitatively

and estimate the deformation values for large number of cycles, the relation after the convergence of initial settlement between u_{max} and number of cycles was approximated by an equation of the fifth degree. Sample load cycles were selected in order to derive the linear equations for both type of section

<i>Normal Stiffness Section</i>		<i>High Stiffness Section</i>	
<i>Load Cycles</i>	<i>Displacement</i>	<i>Load Cycles</i>	<i>Displacement</i>
1	0.00245	1	0.00203
5	0.00625	5	0.00511
10	0.0085	10	0.00498
15	0.00644	15	0.00542
20	0.01099	20	0.00853
25	0.01235	25	0.00661
30	0.01072	30	0.0077
35	0.01288	35	0.0085
40	0.01337	40	0.00974
45	0.01044	45	0.00618
50	0.01266	50	0.00817
55	0.00948	55	0.00583
60	0.01429	60	0.01011
65	0.01398	65	0.01048
70	0.01561	70	0.01178
75	0.01522	75	0.01164
80	0.01492	80	0.01064
85	0.01404	85	0.0102
90	0.01446	90	0.01106
95	0.01417	95	0.01056
100	0.01505	100	0.01101

Table 4.2 Load Cycle selection for development of displacement Equation

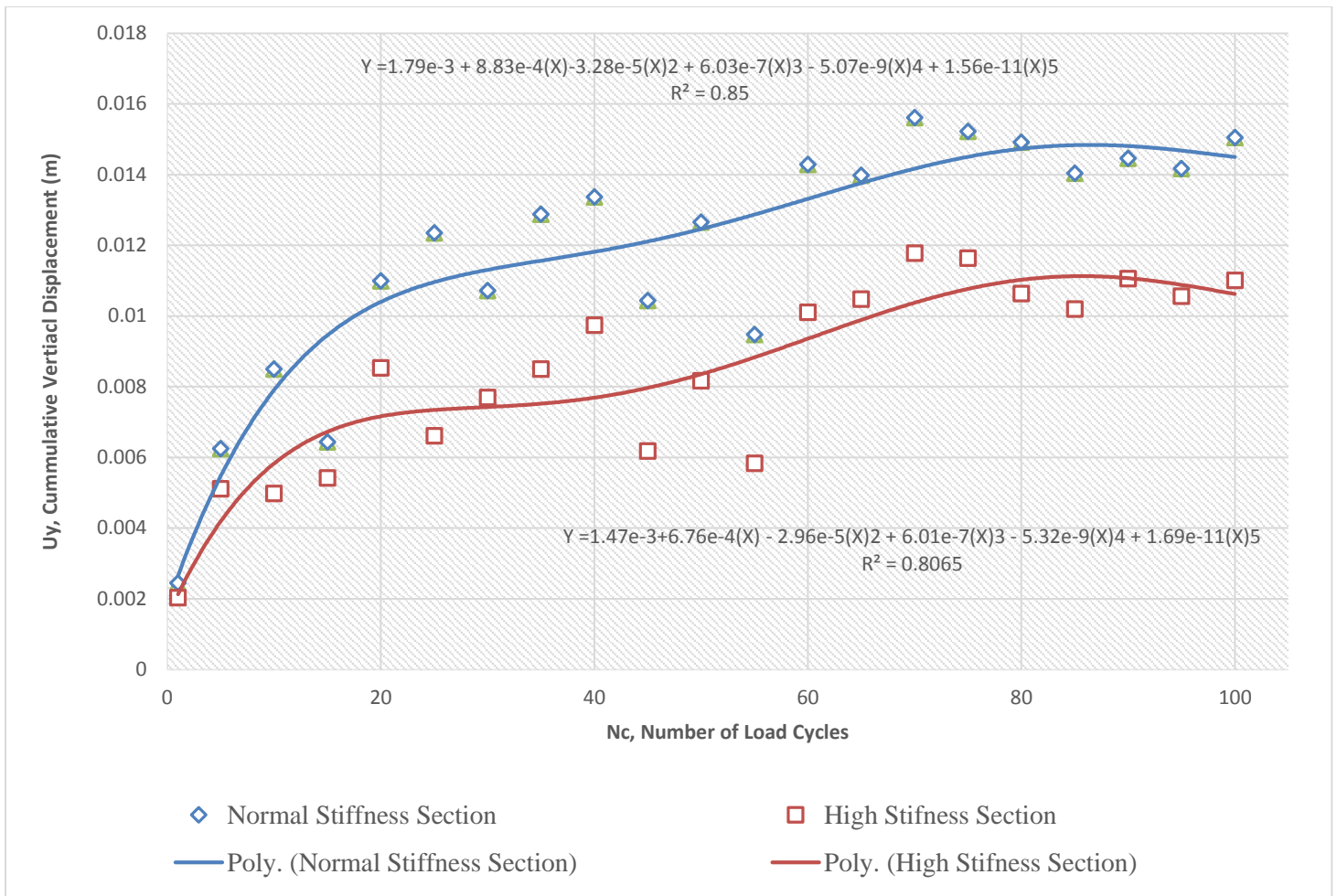


Fig 4.7 Derivation of Relationship between Nc, Number of Load Cycles and Uy, Vertical Displacement

In this case, it is considered that the y-segment of the approximate linear equation represents the amount of initial settlement and its slope represents the rate of progressive settlement after the convergence of initial settlement.

Chapter 5 Conclusion and Recommendation

Railway ballast shows a complex behavior when subjected to repeated loading in laboratory experiments, especially under moving traffic loading. Growth of permanent deformation in railway ballast is a gradual process, during which each load application contributes a small increment to the accumulation. Ballast settlement increases non-linearly with increasing number of load cycles and as track stiffness varies from one section to another, so will the deformational characteristics of the ballast layer on top of it.

In this research, for a specified number of load cycles (100), **26.85 %** settlement difference was recorded between the two sections of the track where stiffness variation occurs. The settlement at the more stiffer side (the section where slab culvert lies underneath the ballast) is lesser than that of the normal section of the track (less stiffer side). This scenario in the long run will result in a differential settlement at the specified section that needs to be routinely inspected and carefully monitoring for the efficient use of the track line.

Recommendations for Future Study

In this thesis work, analysis of differential settlement of ballasted railway track was undertaken on a specific section of Addis Ababa Light Rail Transit line. In addition to what is studied, In order to produce much more practical and helpful results, this area of study need to be investigated in more detail and the following issue is recommended for future research.

Modeling and Simulation

In this research, the effect of One hundred (100) cycle of train passage is modeled and analyzed to observe the settlement pattern. However future works can be based on this work and can expand the scope of the research to estimate the performance of a ballasted railway track at a particular area of interest. As an improvement, future studies can concentrate on estimating the life usage of a ballasted track at transition zones cross referencing it with a standard that sets certain limit on the maximum differential settlement that can be tolerated at these zones of a track. With the help of a powerful analytical tool, the deformation characteristics near theses sections can be calculated and the performance life time of the ballast hence can be obtained to prepare a practical maintenance interval and guide line for use.

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APPENDIX – I

Basic ABAQUS input properties used in the analysis

Vehicle velocity: 45 km/h

Vertical load: 12.5 Ton

Ballast layer thickness: 0.4 m

Pad stiffness k_p : 1×10^8 N/m

Pad Damping C_p : 43,000 NJ/m

Rail: MN50kg Heavy steel rails

Length of track (Symmetrical section): 8.241m

1. Rail and Wheel Parameters

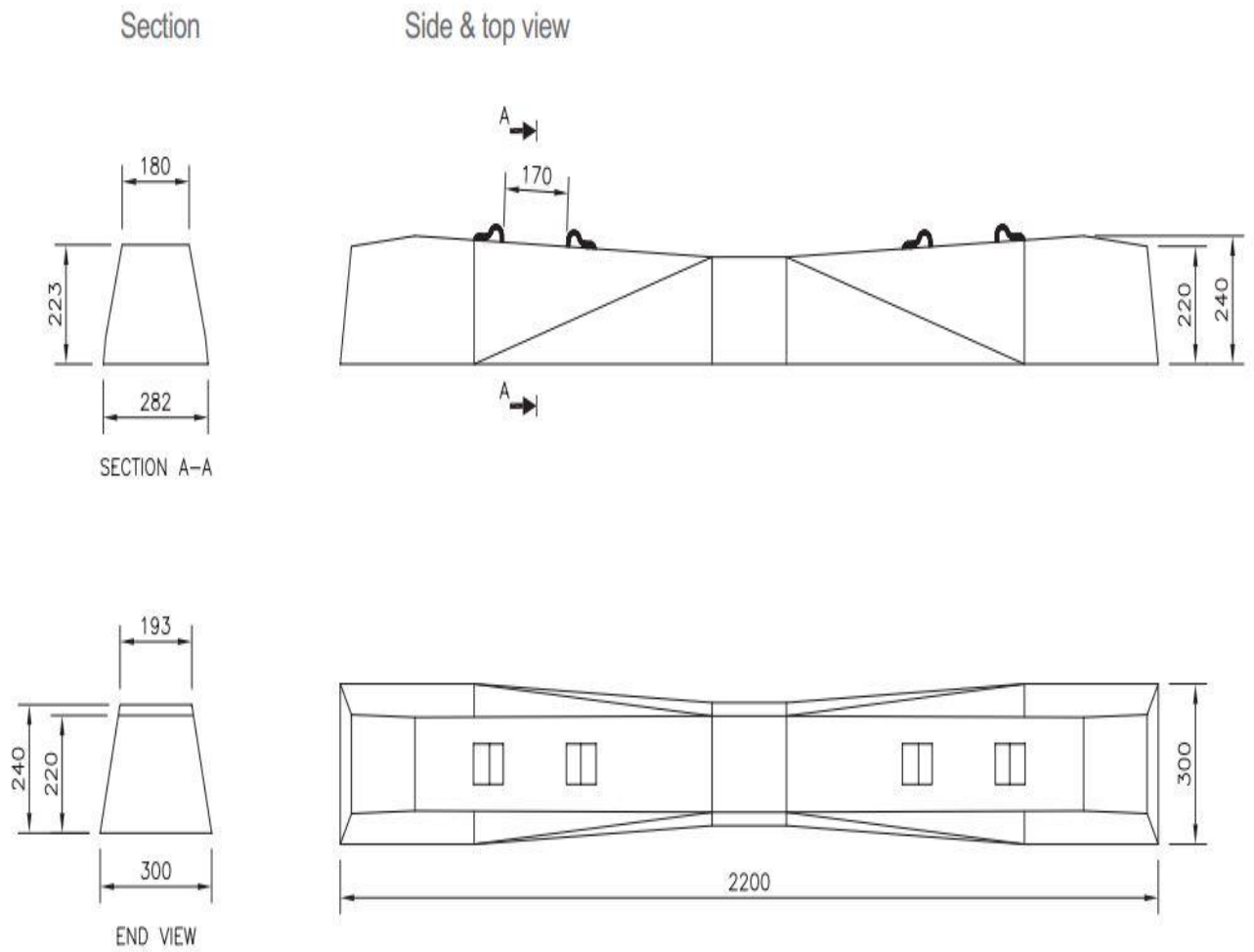
Single Wheel	Diameter (m)	Load	Mass
	0.66 m	125,000 N	1600 Kg

Source: Technical Specifications of Vehicles, China Railway Group Limited, July 2013

Rail	Density	Young Modulus	Poisson's Ratio
	7850 Kg/m ³	210 GPa	0.3

2. Concrete Sleeper

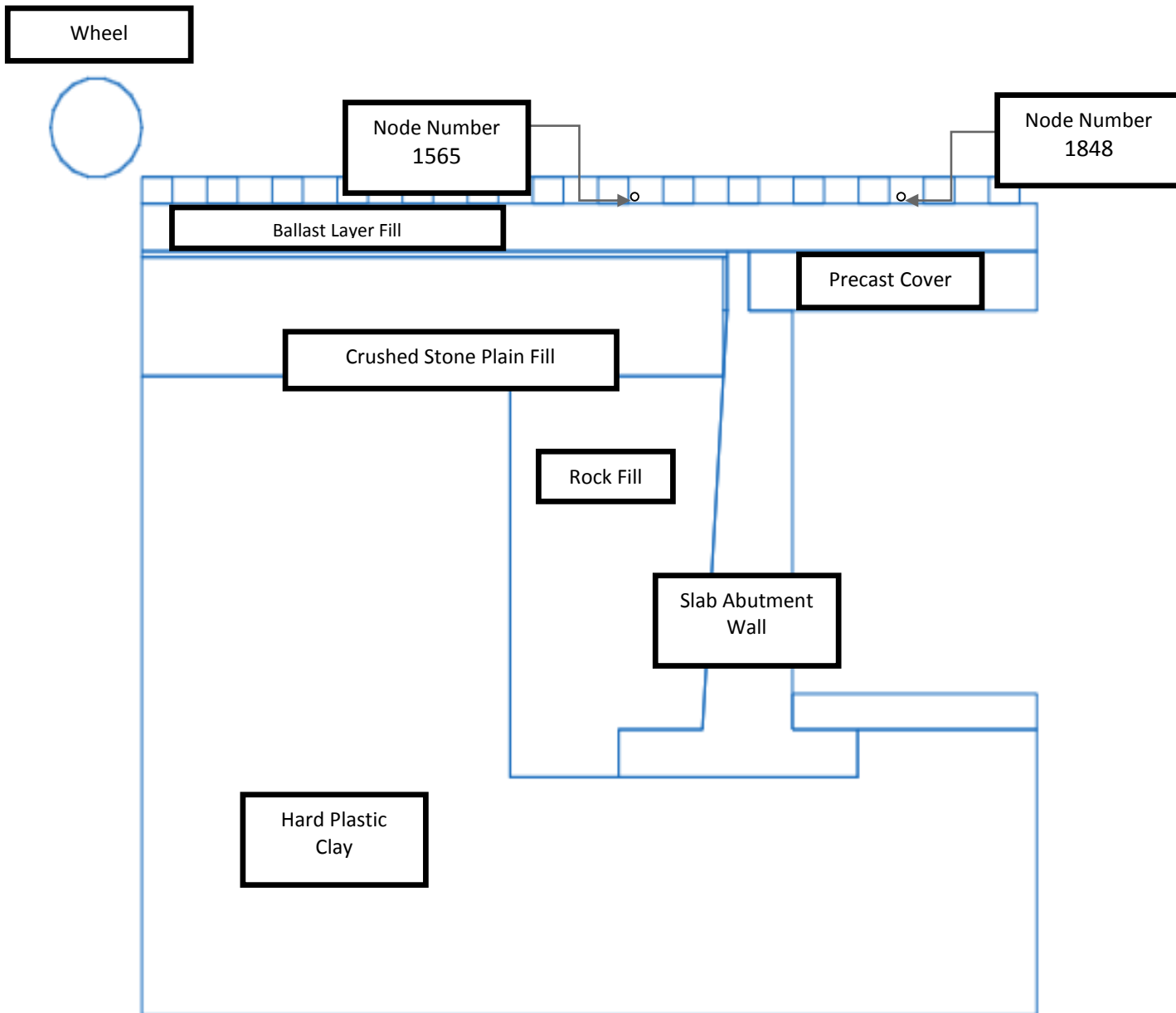
Sleeper	Density	Young Modulus	Poisson's Ratio	Thickness
	2600 Kg/m ³	35 GPa	0.3	0.223m



Sleeper Dimensions

Source: Technical Specifications of prestressed concrete sleeper,

APPENDIX – II



Positions of Nodes under Observation

APPENDIX – III**ABAQUS Cumulative Deformation Output Data for Each Load Cycle**

Load Cycle	Node 1565			Node 1848		
	Time (S)	Displacement (Uy) (m)	Magnitude of Cummulative Displacement Uy (m)	Time (S)	Magnitude of Displacement Uy (m)	Magnitude of Cummulative Displacement Uy (m)
1	0.050	0.00000	0.00000	0.050	0.00000	0.00000
-	0.094	0.00000	0.00000	0.094	0.00000	0.00000
-	0.137	0.00026	0.00026	0.137	-0.00055	0.00055
-	0.181	-0.00051	0.00051	0.181	-0.00045	0.00045
-	0.224	-0.00162	0.00162	0.224	-0.00099	0.00099
-	0.268	-0.00108	0.00108	0.268	-0.00090	0.00090
-	0.312	-0.00161	0.00161	0.312	-0.00078	0.00078
-	0.355	-0.00216	0.00216	0.355	-0.00139	0.00139
-	0.399	-0.00240	0.00240	0.399	-0.00142	0.00142
-	0.443	-0.00247	0.00247	0.443	-0.00140	0.00140
-	0.486	-0.00323	0.00323	0.486	-0.00143	0.00143
-	0.530	-0.00376	0.00376	0.530	-0.00163	0.00163
-	0.573	-0.00391	0.00391	0.573	-0.00183	0.00183
-	0.617	-0.00358	0.00358	0.617	-0.00225	0.00225
-	0.661	-0.00332	0.00332	0.661	-0.00245	0.00245
-	0.704	-0.00311	0.00311	0.704	-0.00243	0.00243
-	0.748	-0.00251	0.00251	0.748	-0.00225	0.00225
-	0.792	-0.00217	0.00217	0.792	-0.00211	0.00211
-	0.835	-0.00236	0.00236	0.835	-0.00207	0.00207
-	0.879	-0.00258	0.00258	0.879	-0.00223	0.00223
-	0.922	-0.00245	0.00245	0.922	-0.00203	0.00203
2	0.922	-0.00245	0.00245	0.922	-0.00203	0.00203
-	0.966	-0.00232	0.00232	0.966	-0.00244	0.00244
-	1.010	-0.00275	0.00275	1.010	-0.00301	0.00301
-	1.053	-0.00315	0.00315	1.053	-0.00296	0.00296
-	1.097	-0.00312	0.00312	1.097	-0.00279	0.00279
-	1.140	-0.00325	0.00325	1.140	-0.00317	0.00317
-	1.184	-0.00317	0.00317	1.184	-0.00292	0.00292
-	1.228	-0.00328	0.00328	1.228	-0.00297	0.00297
-	1.271	-0.00330	0.00330	1.271	-0.00294	0.00294
-	1.315	-0.00322	0.00322	1.315	-0.00272	0.00272
-	1.359	-0.00353	0.00353	1.359	-0.00301	0.00301
-	1.402	-0.00348	0.00348	1.402	-0.00275	0.00275
-	1.446	-0.00343	0.00343	1.446	-0.00305	0.00305
-	1.489	-0.00313	0.00313	1.489	-0.00266	0.00266
-	1.533	-0.00314	0.00314	1.533	-0.00269	0.00269

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	1.577	-0.00315	0.00315	1.577	-0.00249	0.00249
-	1.620	-0.00291	0.00291	1.620	-0.00235	0.00235
-	1.664	-0.00322	0.00322	1.664	-0.00247	0.00247
-	1.707	-0.00328	0.00328	1.707	-0.00267	0.00267
-	1.751	-0.00318	0.00318	1.751	-0.00270	0.00270
-	1.795	-0.00401	0.00401	1.795	-0.00297	0.00297
3	1.795	-0.00401	0.00401	1.795	-0.00297	0.00297
-	1.838	-0.00268	0.00268	1.838	-0.00302	0.00302
-	1.882	0.00025	0.00025	1.882	-0.00146	0.00146
-	1.926	-0.00744	0.00744	1.926	-0.00443	0.00443
-	1.969	-0.00710	0.00710	1.969	-0.00291	0.00291
-	2.013	-0.00512	0.00512	2.013	-0.00100	0.00100
-	2.056	-0.00370	0.00370	2.056	-0.00076	0.00076
-	2.100	-0.00403	0.00403	2.100	-0.00221	0.00221
-	2.144	-0.00425	0.00425	2.144	-0.00272	0.00272
-	2.187	-0.00444	0.00444	2.187	-0.00300	0.00300
-	2.231	-0.00491	0.00491	2.231	-0.00353	0.00353
-	2.275	-0.00331	0.00331	2.275	-0.00286	0.00286
-	2.318	-0.00376	0.00376	2.318	-0.00229	0.00229
-	2.362	-0.00387	0.00387	2.362	-0.00244	0.00244
-	2.405	-0.00352	0.00352	2.405	-0.00235	0.00235
-	2.449	-0.00298	0.00298	2.449	-0.00209	0.00209
-	2.493	-0.00286	0.00286	2.493	-0.00201	0.00201
-	2.536	-0.00409	0.00409	2.536	-0.00239	0.00239
-	2.580	-0.00441	0.00441	2.580	-0.00338	0.00338
-	2.623	-0.00551	0.00551	2.623	-0.00437	0.00437
-	2.667	-0.00546	0.00546	2.667	-0.00424	0.00424
4	2.667	-0.00546	0.00546	2.667	-0.00424	0.00424
-	2.711	-0.00527	0.00527	2.711	-0.00416	0.00416
-	2.754	-0.00579	0.00579	2.754	-0.00456	0.00456
-	2.798	-0.00700	0.00700	2.798	-0.00438	0.00438
-	2.842	-0.00702	0.00702	2.842	-0.00425	0.00425
-	2.885	-0.00596	0.00596	2.885	-0.00376	0.00376
-	2.929	-0.00538	0.00538	2.929	-0.00331	0.00331
-	2.972	-0.00491	0.00491	2.972	-0.00299	0.00299
-	3.016	-0.00398	0.00398	3.016	-0.00239	0.00239
-	3.060	-0.00303	0.00303	3.060	-0.00176	0.00176
-	3.103	-0.00293	0.00293	3.103	-0.00154	0.00154
-	3.147	-0.00296	0.00296	3.147	-0.00130	0.00130
-	3.190	-0.00299	0.00299	3.190	-0.00138	0.00138
-	3.234	-0.00351	0.00351	3.234	-0.00165	0.00165
-	3.278	-0.00365	0.00365	3.278	-0.00180	0.00180
-	3.321	-0.00408	0.00408	3.321	-0.00206	0.00206
-	3.365	-0.00424	0.00424	3.365	-0.00233	0.00233
-	3.409	-0.00475	0.00475	3.409	-0.00272	0.00272
-	3.452	-0.00592	0.00592	3.452	-0.00354	0.00354
-	3.496	-0.00699	0.00699	3.496	-0.00399	0.00399
-	3.539	-0.00786	0.00786	3.539	-0.00450	0.00450

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

5	3.539	-0.00786	0.00786	3.539	-0.00450	0.00450
-	3.583	-0.00588	0.00588	3.583	-0.00406	0.00406
-	3.627	-0.00341	0.00341	3.627	-0.00228	0.00228
-	3.670	-0.00761	0.00761	3.670	-0.00568	0.00568
-	3.714	-0.00969	0.00969	3.714	-0.00430	0.00430
-	3.758	-0.00769	0.00769	3.758	-0.00281	0.00281
-	3.801	-0.00559	0.00559	3.801	-0.00079	0.00079
-	3.845	-0.00433	0.00433	3.845	-0.00225	0.00225
-	3.888	-0.00466	0.00466	3.888	-0.00253	0.00253
-	3.932	-0.00392	0.00392	3.932	-0.00240	0.00240
-	3.976	-0.00354	0.00354	3.976	-0.00172	0.00172
-	4.019	-0.00341	0.00341	4.019	-0.00138	0.00138
-	4.063	-0.00366	0.00366	4.063	-0.00140	0.00140
-	4.106	-0.00372	0.00372	4.106	-0.00131	0.00131
-	4.150	-0.00376	0.00376	4.150	-0.00191	0.00191
-	4.194	-0.00401	0.00401	4.194	-0.00209	0.00209
-	4.237	-0.00392	0.00392	4.237	-0.00209	0.00209
-	4.281	-0.00383	0.00383	4.281	-0.00186	0.00186
-	4.325	-0.00415	0.00415	4.325	-0.00227	0.00227
-	4.368	-0.00554	0.00554	4.368	-0.00367	0.00367
-	4.412	-0.00625	0.00625	4.412	-0.00511	0.00511
6	4.412	-0.00625	0.00625	4.412	-0.00511	0.00511
-	4.455	-0.00767	0.00767	4.455	-0.00582	0.00582
-	4.499	-0.00871	0.00871	4.499	-0.00573	0.00573
-	4.543	-0.00740	0.00740	4.543	-0.00462	0.00462
-	4.586	-0.00632	0.00632	4.586	-0.00361	0.00361
-	4.630	-0.00584	0.00584	4.630	-0.00291	0.00291
-	4.673	-0.00532	0.00532	4.673	-0.00283	0.00283
-	4.717	-0.00481	0.00481	4.717	-0.00268	0.00268
-	4.761	-0.00445	0.00445	4.761	-0.00263	0.00263
-	4.804	-0.00455	0.00455	4.804	-0.00254	0.00254
-	4.848	-0.00470	0.00470	4.848	-0.00237	0.00237
-	4.892	-0.00487	0.00487	4.892	-0.00242	0.00242
-	4.935	-0.00525	0.00525	4.935	-0.00269	0.00269
-	4.979	-0.00571	0.00571	4.979	-0.00310	0.00310
-	5.022	-0.00600	0.00600	5.022	-0.00341	0.00341
-	5.066	-0.00634	0.00634	5.066	-0.00380	0.00380
-	5.110	-0.00656	0.00656	5.110	-0.00397	0.00397
-	5.153	-0.00670	0.00670	5.153	-0.00438	0.00438
-	5.197	-0.00773	0.00773	5.197	-0.00437	0.00437
-	5.241	-0.00879	0.00879	5.241	-0.00518	0.00518
-	5.284	-0.00931	0.00931	5.284	-0.00512	0.00512
7	5.284	-0.00931	0.00931	5.284	-0.00512	0.00512
-	5.328	-0.00854	0.00854	5.328	-0.00582	0.00582
-	5.371	-0.00759	0.00759	5.371	-0.00550	0.00550
-	5.415	-0.00899	0.00899	5.415	-0.00635	0.00635
-	5.459	-0.01136	0.01136	5.459	-0.00549	0.00549
-	5.502	-0.01101	0.01101	5.502	-0.00549	0.00549

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	5.546	-0.00992	0.00992	5.546	-0.00451	0.00451
-	5.589	-0.00619	0.00619	5.589	-0.00343	0.00343
-	5.633	-0.00475	0.00475	5.633	-0.00178	0.00178
-	5.677	-0.00393	0.00393	5.677	-0.00127	0.00127
-	5.720	-0.00288	0.00288	5.720	-0.00021	0.00021
-	5.764	-0.00145	0.00145	5.764	0.00096	0.00096
-	5.808	-0.00089	0.00089	5.808	0.00144	0.00144
-	5.851	-0.00079	0.00079	5.851	0.00206	0.00206
-	5.895	-0.00087	0.00087	5.895	0.00187	0.00187
-	5.938	-0.00093	0.00093	5.938	0.00146	0.00146
-	5.982	-0.00117	0.00117	5.982	0.00123	0.00123
-	6.026	-0.00223	0.00223	6.026	0.00043	0.00043
-	6.069	-0.00311	0.00311	6.069	-0.00075	0.00075
-	6.113	-0.00624	0.00624	6.113	-0.00504	0.00504
-	6.156	-0.00903	0.00903	6.156	-0.00582	0.00582
8	6.156	-0.00903	0.00903	6.156	-0.00582	0.00582
-	6.200	-0.00965	0.00965	6.200	-0.00602	0.00602
-	6.244	-0.01018	0.01018	6.244	-0.00609	0.00609
-	6.287	-0.01012	0.01012	6.287	-0.00554	0.00554
-	6.331	-0.01019	0.01019	6.331	-0.00520	0.00520
-	6.375	-0.01001	0.01001	6.375	-0.00522	0.00522
-	6.418	-0.00983	0.00983	6.418	-0.00549	0.00549
-	6.462	-0.00935	0.00935	6.462	-0.00566	0.00566
-	6.505	-0.00900	0.00900	6.505	-0.00556	0.00556
-	6.549	-0.00865	0.00865	6.549	-0.00526	0.00526
-	6.593	-0.00833	0.00833	6.593	-0.00470	0.00470
-	6.636	-0.00801	0.00801	6.636	-0.00409	0.00409
-	6.680	-0.00791	0.00791	6.680	-0.00372	0.00372
-	6.724	-0.00816	0.00816	6.724	-0.00392	0.00392
-	6.767	-0.00860	0.00860	6.767	-0.00458	0.00458
-	6.811	-0.00883	0.00883	6.811	-0.00493	0.00493
-	6.854	-0.00892	0.00892	6.854	-0.00495	0.00495
-	6.898	-0.00875	0.00875	6.898	-0.00490	0.00490
-	6.942	-0.00885	0.00885	6.942	-0.00499	0.00499
-	6.985	-0.00949	0.00949	6.985	-0.00509	0.00509
-	7.029	-0.01154	0.01154	7.029	-0.00535	0.00535
9	7.029	-0.01154	0.01154	7.029	-0.00535	0.00535
-	7.072	-0.01048	0.01048	7.072	-0.00594	0.00594
-	7.116	-0.00991	0.00991	7.116	-0.00592	0.00592
-	7.160	-0.00902	0.00902	7.160	-0.00554	0.00554
-	7.203	-0.01163	0.01163	7.203	-0.00588	0.00588
-	7.247	-0.01088	0.01088	7.247	-0.00496	0.00496
-	7.291	-0.00883	0.00883	7.291	-0.00289	0.00289
-	7.334	-0.00586	0.00586	7.334	-0.00171	0.00171
-	7.378	-0.00453	0.00453	7.378	-0.00392	0.00392
-	7.421	-0.00405	0.00405	7.421	-0.00358	0.00358
-	7.465	-0.00344	0.00344	7.465	-0.00338	0.00338
-	7.509	-0.00271	0.00271	7.509	-0.00228	0.00228

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	7.552	-0.00186	0.00186	7.552	-0.00093	0.00093
-	7.596	-0.00133	0.00133	7.596	-0.00046	0.00046
-	7.639	-0.00146	0.00146	7.639	0.00012	0.00012
-	7.683	-0.00176	0.00176	7.683	-0.00021	0.00021
-	7.727	-0.00202	0.00202	7.727	-0.00091	0.00091
-	7.770	-0.00217	0.00217	7.770	-0.00167	0.00167
-	7.814	-0.00308	0.00308	7.814	-0.00278	0.00278
-	7.858	-0.00407	0.00407	7.858	-0.00466	0.00466
-	7.901	-0.00604	0.00604	7.901	-0.00605	0.00605
10	7.901	-0.00604	0.00604	7.901	-0.00605	0.00605
-	7.945	-0.00641	0.00641	7.945	-0.00618	0.00618
-	7.988	-0.00721	0.00721	7.988	-0.00627	0.00627
-	8.032	-0.00732	0.00732	8.032	-0.00608	0.00608
-	8.076	-0.00733	0.00733	8.076	-0.00595	0.00595
-	8.119	-0.00730	0.00730	8.119	-0.00594	0.00594
-	8.163	-0.00731	0.00731	8.163	-0.00605	0.00605
-	8.207	-0.00727	0.00727	8.207	-0.00642	0.00642
-	8.250	-0.00667	0.00667	8.250	-0.00609	0.00609
-	8.294	-0.00615	0.00615	8.294	-0.00566	0.00566
-	8.337	-0.00547	0.00547	8.337	-0.00533	0.00533
-	8.381	-0.00508	0.00508	8.381	-0.00466	0.00466
-	8.425	-0.00478	0.00478	8.425	-0.00443	0.00443
-	8.468	-0.00446	0.00446	8.468	-0.00419	0.00419
-	8.512	-0.00461	0.00461	8.512	-0.00407	0.00407
-	8.555	-0.00479	0.00479	8.555	-0.00459	0.00459
-	8.599	-0.00536	0.00536	8.599	-0.00480	0.00480
-	8.643	-0.00586	0.00586	8.643	-0.00532	0.00532
-	8.686	-0.00618	0.00618	8.686	-0.00549	0.00549
-	8.730	-0.00616	0.00616	8.730	-0.00522	0.00522
-	8.774	-0.00850	0.00850	8.774	-0.00498	0.00498
11	8.774	-0.00850	0.00850	8.774	-0.00498	0.00498
-	8.817	-0.01027	0.01027	8.817	-0.00674	0.00674
-	8.861	-0.00870	0.00870	8.861	-0.00621	0.00621
-	8.904	-0.00690	0.00690	8.904	-0.00478	0.00478
-	8.948	-0.01248	0.01248	8.948	-0.00707	0.00707
-	8.992	-0.01154	0.01154	8.992	-0.00547	0.00547
-	9.035	-0.00981	0.00981	9.035	-0.00422	0.00422
-	9.079	-0.00789	0.00789	9.079	-0.00299	0.00299
-	9.123	-0.00649	0.00649	9.123	-0.00344	0.00344
-	9.166	-0.00623	0.00623	9.166	-0.00355	0.00355
-	9.210	-0.00640	0.00640	9.210	-0.00329	0.00329
-	9.253	-0.00642	0.00642	9.253	-0.00278	0.00278
-	9.297	-0.00600	0.00600	9.297	-0.00201	0.00201
-	9.341	-0.00555	0.00555	9.341	-0.00175	0.00175
-	9.384	-0.00587	0.00587	9.384	-0.00174	0.00174
-	9.428	-0.00572	0.00572	9.428	-0.00154	0.00154
-	9.471	-0.00533	0.00533	9.471	-0.00161	0.00161
-	9.515	-0.00495	0.00495	9.515	-0.00157	0.00157

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	9.559	-0.00511	0.00511	9.559	-0.00189	0.00189
-	9.602	-0.00581	0.00581	9.602	-0.00253	0.00253
-	9.646	-0.00639	0.00639	9.646	-0.00495	0.00495
12	9.646	-0.00639	0.00639	9.646	-0.00495	0.00495
-	9.690	-0.00852	0.00852	9.690	-0.00587	0.00587
-	9.733	-0.00861	0.00861	9.733	-0.00559	0.00559
-	9.777	-0.00912	0.00912	9.777	-0.00571	0.00571
-	9.820	-0.00890	0.00890	9.820	-0.00581	0.00581
-	9.864	-0.00894	0.00894	9.864	-0.00579	0.00579
-	9.908	-0.00883	0.00883	9.908	-0.00580	0.00580
-	9.951	-0.00863	0.00863	9.951	-0.00582	0.00582
-	9.995	-0.00835	0.00835	9.995	-0.00595	0.00595
-	10.039	-0.00805	0.00805	10.039	-0.00564	0.00564
-	10.082	-0.00796	0.00796	10.082	-0.00529	0.00529
-	10.126	-0.00771	0.00771	10.126	-0.00492	0.00492
-	10.169	-0.00756	0.00756	10.169	-0.00457	0.00457
-	10.213	-0.00759	0.00759	10.213	-0.00476	0.00476
-	10.257	-0.00782	0.00782	10.257	-0.00490	0.00490
-	10.300	-0.00796	0.00796	10.300	-0.00541	0.00541
-	10.344	-0.00807	0.00807	10.344	-0.00550	0.00550
-	10.387	-0.00766	0.00766	10.387	-0.00522	0.00522
-	10.431	-0.00758	0.00758	10.431	-0.00475	0.00475
-	10.475	-0.00690	0.00690	10.475	-0.00446	0.00446
-	10.518	-0.00846	0.00846	10.518	-0.00431	0.00431
13	10.518	-0.00846	0.00846	10.518	-0.00431	0.00431
-	10.562	-0.01204	0.01204	10.562	-0.00684	0.00684
-	10.606	-0.01143	0.01143	10.606	-0.00718	0.00718
-	10.649	-0.00996	0.00996	10.649	-0.00617	0.00617
-	10.693	-0.01287	0.01287	10.693	-0.00764	0.00764
-	10.736	-0.01268	0.01268	10.736	-0.00682	0.00682
-	10.780	-0.01137	0.01137	10.780	-0.00585	0.00585
-	10.824	-0.00972	0.00972	10.824	-0.00518	0.00518
-	10.867	-0.00811	0.00811	10.867	-0.00589	0.00589
-	10.911	-0.00843	0.00843	10.911	-0.00627	0.00627
-	10.954	-0.00805	0.00805	10.954	-0.00625	0.00625
-	10.998	-0.00806	0.00806	10.998	-0.00529	0.00529
-	11.042	-0.00734	0.00734	11.042	-0.00472	0.00472
-	11.085	-0.00726	0.00726	11.085	-0.00438	0.00438
-	11.129	-0.00726	0.00726	11.129	-0.00426	0.00426
-	11.173	-0.00770	0.00770	11.173	-0.00470	0.00470
-	11.216	-0.00808	0.00808	11.216	-0.00523	0.00523
-	11.260	-0.00810	0.00810	11.260	-0.00590	0.00590
-	11.303	-0.00863	0.00863	11.303	-0.00627	0.00627
-	11.347	-0.00906	0.00906	11.347	-0.00632	0.00632
-	11.391	-0.00962	0.00962	11.391	-0.00738	0.00738
14	11.391	-0.00962	0.00962	11.391	-0.00738	0.00738
-	11.434	-0.01028	0.01028	11.434	-0.00717	0.00717
-	11.478	-0.01014	0.01014	11.478	-0.00622	0.00622

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-	11.522	-0.01013	0.01013	11.522	-0.00604	0.00604
-	11.565	-0.00984	0.00984	11.565	-0.00617	0.00617
-	11.609	-0.00961	0.00961	11.609	-0.00572	0.00572
-	11.652	-0.00898	0.00898	11.652	-0.00537	0.00537
-	11.696	-0.00787	0.00787	11.696	-0.00502	0.00502
-	11.740	-0.00732	0.00732	11.740	-0.00462	0.00462
-	11.783	-0.00718	0.00718	11.783	-0.00443	0.00443
-	11.827	-0.00710	0.00710	11.827	-0.00407	0.00407
-	11.870	-0.00690	0.00690	11.870	-0.00387	0.00387
-	11.914	-0.00685	0.00685	11.914	-0.00401	0.00401
-	11.958	-0.00747	0.00747	11.958	-0.00427	0.00427
-	12.001	-0.00804	0.00804	12.001	-0.00461	0.00461
-	12.045	-0.00811	0.00811	12.045	-0.00477	0.00477
-	12.089	-0.00808	0.00808	12.089	-0.00488	0.00488
-	12.132	-0.00838	0.00838	12.132	-0.00519	0.00519
-	12.176	-0.00919	0.00919	12.176	-0.00569	0.00569
-	12.219	-0.00958	0.00958	12.219	-0.00607	0.00607
-	12.263	-0.00978	0.00978	12.263	-0.00660	0.00660
15	12.263	-0.00978	0.00978	12.263	-0.00660	0.00660
-	12.307	-0.01315	0.01315	12.307	-0.00825	0.00825
-	12.350	-0.01101	0.01101	12.350	-0.00700	0.00700
-	12.394	-0.00952	0.00952	12.394	-0.00564	0.00564
-	12.437	-0.01296	0.01296	12.437	-0.00808	0.00808
-	12.481	-0.01245	0.01245	12.481	-0.00705	0.00705
-	12.525	-0.01002	0.01002	12.525	-0.00541	0.00541
-	12.568	-0.00802	0.00802	12.568	-0.00361	0.00361
-	12.612	-0.00621	0.00621	12.612	-0.00504	0.00504
-	12.656	-0.00661	0.00661	12.656	-0.00543	0.00543
-	12.699	-0.00593	0.00593	12.699	-0.00520	0.00520
-	12.743	-0.00534	0.00534	12.743	-0.00450	0.00450
-	12.786	-0.00488	0.00488	12.786	-0.00390	0.00390
-	12.830	-0.00467	0.00467	12.830	-0.00352	0.00352
-	12.874	-0.00477	0.00477	12.874	-0.00329	0.00329
-	12.917	-0.00473	0.00473	12.917	-0.00360	0.00360
-	12.961	-0.00514	0.00514	12.961	-0.00389	0.00389
-	13.005	-0.00549	0.00549	13.005	-0.00461	0.00461
-	13.048	-0.00620	0.00620	13.048	-0.00503	0.00503
-	13.092	-0.00641	0.00641	13.092	-0.00507	0.00507
-	13.135	-0.00644	0.00644	13.135	-0.00542	0.00542
16	13.135	-0.00644	0.00644	13.135	-0.00542	0.00542
-	13.179	-0.00746	0.00746	13.179	-0.00578	0.00578
-	13.223	-0.00927	0.00927	13.223	-0.00632	0.00632
-	13.266	-0.01005	0.01005	13.266	-0.00643	0.00643
-	13.310	-0.01019	0.01019	13.310	-0.00671	0.00671
-	13.353	-0.01029	0.01029	13.353	-0.00695	0.00695
-	13.397	-0.01077	0.01077	13.397	-0.00729	0.00729
-	13.441	-0.01121	0.01121	13.441	-0.00771	0.00771
-	13.484	-0.01069	0.01069	13.484	-0.00746	0.00746

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	13.528	-0.00998	0.00998	13.528	-0.00719	0.00719
-	13.572	-0.00929	0.00929	13.572	-0.00651	0.00651
-	13.615	-0.00907	0.00907	13.615	-0.00590	0.00590
-	13.659	-0.00849	0.00849	13.659	-0.00564	0.00564
-	13.702	-0.00782	0.00782	13.702	-0.00504	0.00504
-	13.746	-0.00747	0.00747	13.746	-0.00512	0.00512
-	13.790	-0.00759	0.00759	13.790	-0.00486	0.00486
-	13.833	-0.00766	0.00766	13.833	-0.00494	0.00494
-	13.877	-0.00768	0.00768	13.877	-0.00493	0.00493
-	13.920	-0.00742	0.00742	13.920	-0.00458	0.00458
-	13.964	-0.00760	0.00760	13.964	-0.00479	0.00479
-	14.008	-0.01199	0.01199	14.008	-0.00585	0.00585
17	14.008	-0.01199	0.01199	14.008	-0.00585	0.00585
-	14.051	-0.01377	0.01377	14.051	-0.00796	0.00796
-	14.095	-0.01322	0.01322	14.095	-0.00679	0.00679
-	14.139	-0.01206	0.01206	14.139	-0.00618	0.00618
-	14.182	-0.01423	0.01423	14.182	-0.00909	0.00909
-	14.226	-0.01309	0.01309	14.226	-0.00658	0.00658
-	14.269	-0.01118	0.01118	14.269	-0.00456	0.00456
-	14.313	-0.00887	0.00887	14.313	-0.00275	0.00275
-	14.357	-0.00742	0.00742	14.357	-0.00787	0.00787
-	14.400	-0.01022	0.01022	14.400	-0.00863	0.00863
-	14.444	-0.00963	0.00963	14.444	-0.00806	0.00806
-	14.488	-0.00900	0.00900	14.488	-0.00695	0.00695
-	14.531	-0.00760	0.00760	14.531	-0.00654	0.00654
-	14.575	-0.00750	0.00750	14.575	-0.00659	0.00659
-	14.618	-0.00782	0.00782	14.618	-0.00660	0.00660
-	14.662	-0.00724	0.00724	14.662	-0.00651	0.00651
-	14.706	-0.00631	0.00631	14.706	-0.00589	0.00589
-	14.749	-0.00567	0.00567	14.749	-0.00545	0.00545
-	14.793	-0.00615	0.00615	14.793	-0.00494	0.00494
-	14.836	-0.00695	0.00695	14.836	-0.00612	0.00612
-	14.880	-0.00743	0.00743	14.880	-0.00707	0.00707
18	14.880	-0.00743	0.00743	14.880	-0.00707	0.00707
-	14.924	-0.00828	0.00828	14.924	-0.00789	0.00789
-	14.967	-0.00928	0.00928	14.967	-0.00747	0.00747
-	15.011	-0.00906	0.00906	15.011	-0.00730	0.00730
-	15.055	-0.00901	0.00901	15.055	-0.00712	0.00712
-	15.098	-0.00871	0.00871	15.098	-0.00697	0.00697
-	15.142	-0.00898	0.00898	15.142	-0.00733	0.00733
-	15.185	-0.00897	0.00897	15.185	-0.00783	0.00783
-	15.229	-0.00882	0.00882	15.229	-0.00798	0.00798
-	15.273	-0.00871	0.00871	15.273	-0.00775	0.00775
-	15.316	-0.00833	0.00833	15.316	-0.00735	0.00735
-	15.360	-0.00838	0.00838	15.360	-0.00699	0.00699
-	15.404	-0.00829	0.00829	15.404	-0.00690	0.00690
-	15.447	-0.00842	0.00842	15.447	-0.00689	0.00689
-	15.491	-0.00859	0.00859	15.491	-0.00740	0.00740

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	15.534	-0.00872	0.00872	15.534	-0.00730	0.00730
-	15.578	-0.00857	0.00857	15.578	-0.00718	0.00718
-	15.622	-0.00820	0.00820	15.622	-0.00712	0.00712
-	15.665	-0.00820	0.00820	15.665	-0.00703	0.00703
-	15.709	-0.00840	0.00840	15.709	-0.00715	0.00715
-	15.752	-0.00921	0.00921	15.752	-0.00726	0.00726
19	15.752	-0.00921	0.00921	15.752	-0.00726	0.00726
-	15.796	-0.01261	0.01261	15.796	-0.00814	0.00814
-	15.840	-0.01306	0.01306	15.840	-0.00906	0.00906
-	15.883	-0.01208	0.01208	15.883	-0.00829	0.00829
-	15.927	-0.01264	0.01264	15.927	-0.00886	0.00886
-	15.971	-0.01441	0.01441	15.971	-0.00856	0.00856
-	16.014	-0.01300	0.01300	16.014	-0.00759	0.00759
-	16.058	-0.01148	0.01148	16.058	-0.00639	0.00639
-	16.101	-0.00984	0.00984	16.101	-0.00713	0.00713
-	16.145	-0.01076	0.01076	16.145	-0.00881	0.00881
-	16.189	-0.01051	0.01051	16.189	-0.00831	0.00831
-	16.232	-0.00995	0.00995	16.232	-0.00757	0.00757
-	16.276	-0.00931	0.00931	16.276	-0.00721	0.00721
-	16.319	-0.00923	0.00923	16.319	-0.00683	0.00683
-	16.363	-0.00937	0.00937	16.363	-0.00704	0.00704
-	16.407	-0.00929	0.00929	16.407	-0.00704	0.00704
-	16.450	-0.00889	0.00889	16.450	-0.00650	0.00650
-	16.494	-0.00842	0.00842	16.494	-0.00649	0.00649
-	16.538	-0.00848	0.00848	16.538	-0.00646	0.00646
-	16.581	-0.00882	0.00882	16.581	-0.00672	0.00672
-	16.625	-0.00919	0.00919	16.625	-0.00807	0.00807
20	16.625	-0.00919	0.00919	16.625	-0.00807	0.00807
-	16.668	-0.01000	0.01000	16.668	-0.00772	0.00772
-	16.712	-0.00959	0.00959	16.712	-0.00666	0.00666
-	16.756	-0.00891	0.00891	16.756	-0.00596	0.00596
-	16.799	-0.00796	0.00796	16.799	-0.00516	0.00516
-	16.843	-0.00789	0.00789	16.843	-0.00504	0.00504
-	16.887	-0.00763	0.00763	16.887	-0.00506	0.00506
-	16.930	-0.00682	0.00682	16.930	-0.00497	0.00497
-	16.974	-0.00625	0.00625	16.974	-0.00492	0.00492
-	17.017	-0.00599	0.00599	17.017	-0.00440	0.00440
-	17.061	-0.00591	0.00591	17.061	-0.00420	0.00420
-	17.105	-0.00594	0.00594	17.105	-0.00408	0.00408
-	17.148	-0.00610	0.00610	17.148	-0.00428	0.00428
-	17.192	-0.00702	0.00702	17.192	-0.00497	0.00497
-	17.235	-0.00792	0.00792	17.235	-0.00579	0.00579
-	17.279	-0.00883	0.00883	17.279	-0.00680	0.00680
-	17.323	-0.00964	0.00964	17.323	-0.00781	0.00781
-	17.366	-0.01037	0.01037	17.366	-0.00804	0.00804
-	17.410	-0.01109	0.01109	17.410	-0.00838	0.00838
-	17.454	-0.01129	0.01129	17.454	-0.00852	0.00852
-	17.497	-0.01099	0.01099	17.497	-0.00853	0.00853

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21	17.497	-0.01099	0.01099	17.497	-0.00853	0.00853
-	17.541	-0.01174	0.01174	17.541	-0.00774	0.00774
-	17.584	-0.01163	0.01163	17.584	-0.00824	0.00824
-	17.628	-0.01108	0.01108	17.628	-0.00776	0.00776
-	17.672	-0.01058	0.01058	17.672	-0.00799	0.00799
-	17.715	-0.01531	0.01531	17.715	-0.00903	0.00903
-	17.759	-0.01480	0.01480	17.759	-0.00826	0.00826
-	17.802	-0.01371	0.01371	17.802	-0.00782	0.00782
-	17.846	-0.01213	0.01213	17.846	-0.00659	0.00659
-	17.890	-0.01121	0.01121	17.890	-0.00570	0.00570
-	17.933	-0.01091	0.01091	17.933	-0.00520	0.00520
-	17.977	-0.01015	0.01015	17.977	-0.00424	0.00424
-	18.021	-0.00975	0.00975	18.021	-0.00427	0.00427
-	18.064	-0.01021	0.01021	18.064	-0.00510	0.00510
-	18.108	-0.01132	0.01132	18.108	-0.00552	0.00552
-	18.151	-0.01159	0.01159	18.151	-0.00557	0.00557
-	18.195	-0.01131	0.01131	18.195	-0.00527	0.00527
-	18.239	-0.01148	0.01148	18.239	-0.00533	0.00533
-	18.282	-0.01224	0.01224	18.282	-0.00595	0.00595
-	18.326	-0.01272	0.01272	18.326	-0.00638	0.00638
-	18.370	-0.01280	0.01280	18.370	-0.00687	0.00687
22	18.370	-0.01280	0.01280	18.370	-0.00687	0.00687
-	18.413	-0.01295	0.01295	18.413	-0.00799	0.00799
-	18.457	-0.01499	0.01499	18.457	-0.00888	0.00888
-	18.500	-0.01504	0.01504	18.500	-0.00902	0.00902
-	18.544	-0.01475	0.01475	18.544	-0.00868	0.00868
-	18.588	-0.01408	0.01408	18.588	-0.00867	0.00867
-	18.631	-0.01394	0.01394	18.631	-0.00806	0.00806
-	18.675	-0.01324	0.01324	18.675	-0.00781	0.00781
-	18.718	-0.01286	0.01286	18.718	-0.00786	0.00786
-	18.762	-0.01275	0.01275	18.762	-0.00795	0.00795
-	18.806	-0.01308	0.01308	18.806	-0.00806	0.00806
-	18.849	-0.01332	0.01332	18.849	-0.00815	0.00815
-	18.893	-0.01334	0.01334	18.893	-0.00815	0.00815
-	18.937	-0.01392	0.01392	18.937	-0.00847	0.00847
-	18.980	-0.01426	0.01426	18.980	-0.00850	0.00850
-	19.024	-0.01460	0.01460	19.024	-0.00879	0.00879
-	19.067	-0.01453	0.01453	19.067	-0.00909	0.00909
-	19.111	-0.01484	0.01484	19.111	-0.00921	0.00921
-	19.155	-0.01486	0.01486	19.155	-0.00933	0.00933
-	19.198	-0.01482	0.01482	19.198	-0.00933	0.00933
-	19.242	-0.01427	0.01427	19.242	-0.00907	0.00907
23	19.242	-0.01427	0.01427	19.242	-0.00907	0.00907
-	19.285	-0.01447	0.01447	19.285	-0.00851	0.00851
-	19.329	-0.01479	0.01479	19.329	-0.00866	0.00866
-	19.373	-0.01437	0.01437	19.373	-0.00833	0.00833
-	19.416	-0.01386	0.01386	19.416	-0.00801	0.00801
-	19.460	-0.01435	0.01435	19.460	-0.00904	0.00904

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	19.504	-0.01378	0.01378	19.504	-0.00824	0.00824
-	19.547	-0.01269	0.01269	19.547	-0.00699	0.00699
-	19.591	-0.01138	0.01138	19.591	-0.00597	0.00597
-	19.634	-0.01061	0.01061	19.634	-0.00536	0.00536
-	19.678	-0.01008	0.01008	19.678	-0.00503	0.00503
-	19.722	-0.00947	0.00947	19.722	-0.00435	0.00435
-	19.765	-0.00892	0.00892	19.765	-0.00413	0.00413
-	19.809	-0.00875	0.00875	19.809	-0.00407	0.00407
-	19.853	-0.00876	0.00876	19.853	-0.00403	0.00403
-	19.896	-0.00867	0.00867	19.896	-0.00391	0.00391
-	19.940	-0.00898	0.00898	19.940	-0.00425	0.00425
-	19.983	-0.00968	0.00968	19.983	-0.00475	0.00475
-	20.027	-0.01030	0.01030	20.027	-0.00527	0.00527
-	20.071	-0.01097	0.01097	20.071	-0.00579	0.00579
-	20.114	-0.01170	0.01170	20.114	-0.00635	0.00635
24	20.114	-0.01170	0.01170	20.114	-0.00635	0.00635
-	20.158	-0.01257	0.01257	20.158	-0.00848	0.00848
-	20.201	-0.01467	0.01467	20.201	-0.00781	0.00781
-	20.245	-0.01337	0.01337	20.245	-0.00622	0.00622
-	20.289	-0.01200	0.01200	20.289	-0.00493	0.00493
-	20.332	-0.01074	0.01074	20.332	-0.00413	0.00413
-	20.376	-0.01003	0.01003	20.376	-0.00424	0.00424
-	20.420	-0.00941	0.00941	20.420	-0.00377	0.00377
-	20.463	-0.00859	0.00859	20.463	-0.00362	0.00362
-	20.507	-0.00824	0.00824	20.507	-0.00308	0.00308
-	20.550	-0.00791	0.00791	20.550	-0.00261	0.00261
-	20.594	-0.00805	0.00805	20.594	-0.00249	0.00249
-	20.638	-0.00823	0.00823	20.638	-0.00252	0.00252
-	20.681	-0.00850	0.00850	20.681	-0.00271	0.00271
-	20.725	-0.00912	0.00912	20.725	-0.00323	0.00323
-	20.768	-0.00973	0.00973	20.768	-0.00400	0.00400
-	20.812	-0.01034	0.01034	20.812	-0.00486	0.00486
-	20.856	-0.01088	0.01088	20.856	-0.00542	0.00542
-	20.899	-0.01153	0.01153	20.899	-0.00586	0.00586
-	20.943	-0.01234	0.01234	20.943	-0.00625	0.00625
-	20.987	-0.01246	0.01246	20.987	-0.00676	0.00676
25	20.987	-0.01246	0.01246	20.987	-0.00676	0.00676
-	21.030	-0.01379	0.01379	21.030	-0.00933	0.00933
-	21.074	-0.01454	0.01454	21.074	-0.00949	0.00949
-	21.117	-0.01407	0.01407	21.117	-0.00906	0.00906
-	21.161	-0.01301	0.01301	21.161	-0.00862	0.00862
-	21.205	-0.01507	0.01507	21.205	-0.00956	0.00956
-	21.248	-0.01420	0.01420	21.248	-0.00830	0.00830
-	21.292	-0.01338	0.01338	21.292	-0.00704	0.00704
-	21.336	-0.01167	0.01167	21.336	-0.00604	0.00604
-	21.379	-0.01147	0.01147	21.379	-0.00607	0.00607
-	21.423	-0.01197	0.01197	21.423	-0.00586	0.00586
-	21.466	-0.01207	0.01207	21.466	-0.00627	0.00627

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	21.510	-0.01188	0.01188	21.510	-0.00608	0.00608
-	21.554	-0.01242	0.01242	21.554	-0.00735	0.00735
-	21.597	-0.01281	0.01281	21.597	-0.00786	0.00786
-	21.641	-0.01304	0.01304	21.641	-0.00786	0.00786
-	21.684	-0.01291	0.01291	21.684	-0.00812	0.00812
-	21.728	-0.01278	0.01278	21.728	-0.00729	0.00729
-	21.772	-0.01280	0.01280	21.772	-0.00714	0.00714
-	21.815	-0.01285	0.01285	21.815	-0.00689	0.00689
-	21.859	-0.01235	0.01235	21.859	-0.00661	0.00661
26	21.859	-0.01235	0.01235	21.859	-0.00661	0.00661
-	21.903	-0.01219	0.01219	21.903	-0.00806	0.00806
-	21.946	-0.01535	0.01535	21.946	-0.00891	0.00891
-	21.990	-0.01499	0.01499	21.990	-0.00828	0.00828
-	22.033	-0.01432	0.01432	22.033	-0.00782	0.00782
-	22.077	-0.01318	0.01318	22.077	-0.00755	0.00755
-	22.121	-0.01314	0.01314	22.121	-0.00760	0.00760
-	22.164	-0.01281	0.01281	22.164	-0.00744	0.00744
-	22.208	-0.01248	0.01248	22.208	-0.00745	0.00745
-	22.251	-0.01223	0.01223	22.251	-0.00703	0.00703
-	22.295	-0.01220	0.01220	22.295	-0.00677	0.00677
-	22.339	-0.01234	0.01234	22.339	-0.00667	0.00667
-	22.382	-0.01253	0.01253	22.382	-0.00675	0.00675
-	22.426	-0.01298	0.01298	22.426	-0.00723	0.00723
-	22.470	-0.01326	0.01326	22.470	-0.00773	0.00773
-	22.513	-0.01350	0.01350	22.513	-0.00807	0.00807
-	22.557	-0.01376	0.01376	22.557	-0.00846	0.00846
-	22.600	-0.01429	0.01429	22.600	-0.00870	0.00870
-	22.644	-0.01465	0.01465	22.644	-0.00890	0.00890
-	22.688	-0.01477	0.01477	22.688	-0.00900	0.00900
-	22.731	-0.01467	0.01467	22.731	-0.00868	0.00868
27	22.731	-0.01467	0.01467	22.731	-0.00868	0.00868
-	22.775	-0.01520	0.01520	22.775	-0.00826	0.00826
-	22.819	-0.01485	0.01485	22.819	-0.00841	0.00841
-	22.862	-0.01404	0.01404	22.862	-0.00815	0.00815
-	22.906	-0.01435	0.01435	22.906	-0.00809	0.00809
-	22.949	-0.01517	0.01517	22.949	-0.00963	0.00963
-	22.993	-0.01346	0.01346	22.993	-0.00793	0.00793
-	23.037	-0.01224	0.01224	23.037	-0.00691	0.00691
-	23.080	-0.01079	0.01079	23.080	-0.00546	0.00546
-	23.124	-0.01034	0.01034	23.124	-0.00572	0.00572
-	23.167	-0.01011	0.01011	23.167	-0.00574	0.00574
-	23.211	-0.01042	0.01042	23.211	-0.00580	0.00580
-	23.255	-0.01052	0.01052	23.255	-0.00587	0.00587
-	23.298	-0.01065	0.01065	23.298	-0.00550	0.00550
-	23.342	-0.01101	0.01101	23.342	-0.00589	0.00589
-	23.386	-0.01112	0.01112	23.386	-0.00584	0.00584
-	23.429	-0.01144	0.01144	23.429	-0.00607	0.00607
-	23.473	-0.01169	0.01169	23.473	-0.00664	0.00664

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	23.516	-0.01202	0.01202	23.516	-0.00674	0.00674
-	23.560	-0.01234	0.01234	23.560	-0.00737	0.00737
-	23.604	-0.01221	0.01221	23.604	-0.00721	0.00721
28	23.604	-0.01221	0.01221	23.604	-0.00721	0.00721
-	23.647	-0.01243	0.01243	23.647	-0.00758	0.00758
-	23.691	-0.01313	0.01313	23.691	-0.00778	0.00778
-	23.734	-0.01302	0.01302	23.734	-0.00680	0.00680
-	23.778	-0.01234	0.01234	23.778	-0.00609	0.00609
-	23.822	-0.01173	0.01173	23.822	-0.00585	0.00585
-	23.865	-0.01186	0.01186	23.865	-0.00606	0.00606
-	23.909	-0.01175	0.01175	23.909	-0.00628	0.00628
-	23.953	-0.01090	0.01090	23.953	-0.00589	0.00589
-	23.996	-0.01007	0.01007	23.996	-0.00548	0.00548
-	24.040	-0.00987	0.00987	24.040	-0.00460	0.00460
-	24.083	-0.00969	0.00969	24.083	-0.00416	0.00416
-	24.127	-0.00929	0.00929	24.127	-0.00382	0.00382
-	24.171	-0.00913	0.00913	24.171	-0.00383	0.00383
-	24.214	-0.00966	0.00966	24.214	-0.00446	0.00446
-	24.258	-0.01039	0.01039	24.258	-0.00503	0.00503
-	24.302	-0.01044	0.01044	24.302	-0.00552	0.00552
-	24.345	-0.01055	0.01055	24.345	-0.00568	0.00568
-	24.389	-0.01104	0.01104	24.389	-0.00560	0.00560
-	24.432	-0.01174	0.01174	24.432	-0.00577	0.00577
-	24.476	-0.01242	0.01242	24.476	-0.00585	0.00585
29	24.476	-0.01242	0.01242	24.476	-0.00585	0.00585
-	24.520	-0.01280	0.01280	24.520	-0.00742	0.00742
-	24.563	-0.01455	0.01455	24.563	-0.00845	0.00845
-	24.607	-0.01430	0.01430	24.607	-0.00868	0.00868
-	24.650	-0.01428	0.01428	24.650	-0.00823	0.00823
-	24.694	-0.01544	0.01544	24.694	-0.00985	0.00985
-	24.738	-0.01248	0.01248	24.738	-0.00613	0.00613
-	24.781	-0.01008	0.01008	24.781	-0.00372	0.00372
-	24.825	-0.00748	0.00748	24.825	-0.00448	0.00448
-	24.869	-0.00827	0.00827	24.869	-0.00504	0.00504
-	24.912	-0.00780	0.00780	24.912	-0.00540	0.00540
-	24.956	-0.00727	0.00727	24.956	-0.00497	0.00497
-	24.999	-0.00674	0.00674	24.999	-0.00468	0.00468
-	25.043	-0.00644	0.00644	25.043	-0.00413	0.00413
-	25.087	-0.00636	0.00636	25.087	-0.00343	0.00343
-	25.130	-0.00596	0.00596	25.130	-0.00343	0.00343
-	25.174	-0.00606	0.00606	25.174	-0.00326	0.00326
-	25.217	-0.00641	0.00641	25.217	-0.00387	0.00387
-	25.261	-0.00695	0.00695	25.261	-0.00444	0.00444
-	25.305	-0.00711	0.00711	25.305	-0.00492	0.00492
-	25.348	-0.00723	0.00723	25.348	-0.00540	0.00540
30	25.348	-0.00723	0.00723	25.348	-0.00540	0.00540
-	25.392	-0.00785	0.00785	25.392	-0.00646	0.00646
-	25.436	-0.00876	0.00876	25.436	-0.00670	0.00670

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	25.479	-0.00912	0.00912	25.479	-0.00570	0.00570
-	25.523	-0.00837	0.00837	25.523	-0.00502	0.00502
-	25.566	-0.00777	0.00777	25.566	-0.00390	0.00390
-	25.610	-0.00717	0.00717	25.610	-0.00338	0.00338
-	25.654	-0.00673	0.00673	25.654	-0.00325	0.00325
-	25.697	-0.00573	0.00573	25.697	-0.00269	0.00269
-	25.741	-0.00463	0.00463	25.741	-0.00246	0.00246
-	25.785	-0.00380	0.00380	25.785	-0.00199	0.00199
-	25.828	-0.00343	0.00343	25.828	-0.00165	0.00165
-	25.872	-0.00344	0.00344	25.872	-0.00157	0.00157
-	25.915	-0.00358	0.00358	25.915	-0.00157	0.00157
-	25.959	-0.00403	0.00403	25.959	-0.00187	0.00187
-	26.003	-0.00492	0.00492	26.003	-0.00261	0.00261
-	26.046	-0.00619	0.00619	26.046	-0.00337	0.00337
-	26.090	-0.00732	0.00732	26.090	-0.00458	0.00458
-	26.133	-0.00847	0.00847	26.133	-0.00587	0.00587
-	26.177	-0.00961	0.00961	26.177	-0.00690	0.00690
-	26.221	-0.01072	0.01072	26.221	-0.00770	0.00770
31	26.221	-0.01072	0.01072	26.221	-0.00770	0.00770
-	26.264	-0.01141	0.01141	26.264	-0.00776	0.00776
-	26.308	-0.01239	0.01239	26.308	-0.00833	0.00833
-	26.352	-0.01288	0.01288	26.352	-0.00861	0.00861
-	26.395	-0.01252	0.01252	26.395	-0.00907	0.00907
-	26.439	-0.01531	0.01531	26.439	-0.01036	0.01036
-	26.482	-0.01410	0.01410	26.482	-0.00835	0.00835
-	26.526	-0.01276	0.01276	26.526	-0.00739	0.00739
-	26.570	-0.01140	0.01140	26.570	-0.00600	0.00600
-	26.613	-0.01057	0.01057	26.613	-0.00544	0.00544
-	26.657	-0.00995	0.00995	26.657	-0.00516	0.00516
-	26.701	-0.00950	0.00950	26.701	-0.00495	0.00495
-	26.744	-0.00945	0.00945	26.744	-0.00479	0.00479
-	26.788	-0.00977	0.00977	26.788	-0.00523	0.00523
-	26.831	-0.00972	0.00972	26.831	-0.00534	0.00534
-	26.875	-0.00954	0.00954	26.875	-0.00521	0.00521
-	26.919	-0.00972	0.00972	26.919	-0.00509	0.00509
-	26.962	-0.01020	0.01020	26.962	-0.00531	0.00531
-	27.006	-0.01073	0.01073	27.006	-0.00589	0.00589
-	27.049	-0.01142	0.01142	27.049	-0.00651	0.00651
-	27.093	-0.01190	0.01190	27.093	-0.00714	0.00714
32	27.093	-0.01190	0.01190	27.093	-0.00714	0.00714
-	27.137	-0.01233	0.01233	27.137	-0.00751	0.00751
-	27.180	-0.01496	0.01496	27.180	-0.01019	0.01019
-	27.224	-0.01348	0.01348	27.224	-0.00867	0.00867
-	27.268	-0.01290	0.01290	27.268	-0.00751	0.00751
-	27.311	-0.01188	0.01188	27.311	-0.00634	0.00634
-	27.355	-0.01092	0.01092	27.355	-0.00611	0.00611
-	27.398	-0.01007	0.01007	27.398	-0.00582	0.00582
-	27.442	-0.00995	0.00995	27.442	-0.00577	0.00577

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	27.486	-0.01030	0.01030	27.486	-0.00583	0.00583
-	27.529	-0.01012	0.01012	27.529	-0.00565	0.00565
-	27.573	-0.01028	0.01028	27.573	-0.00584	0.00584
-	27.616	-0.01095	0.01095	27.616	-0.00620	0.00620
-	27.660	-0.01169	0.01169	27.660	-0.00663	0.00663
-	27.704	-0.01218	0.01218	27.704	-0.00719	0.00719
-	27.747	-0.01256	0.01256	27.747	-0.00772	0.00772
-	27.791	-0.01310	0.01310	27.791	-0.00769	0.00769
-	27.835	-0.01335	0.01335	27.835	-0.00839	0.00839
-	27.878	-0.01350	0.01350	27.878	-0.00859	0.00859
-	27.922	-0.01399	0.01399	27.922	-0.00912	0.00912
-	27.965	-0.01426	0.01426	27.965	-0.00946	0.00946
33	27.965	-0.01426	0.01426	27.965	-0.00946	0.00946
-	28.009	-0.01434	0.01434	28.009	-0.00904	0.00904
-	28.053	-0.01430	0.01430	28.053	-0.00949	0.00949
-	28.096	-0.01413	0.01413	28.096	-0.00894	0.00894
-	28.140	-0.01399	0.01399	28.140	-0.00908	0.00908
-	28.184	-0.01384	0.01384	28.184	-0.00992	0.00992
-	28.227	-0.01386	0.01386	28.227	-0.01000	0.01000
-	28.271	-0.01317	0.01317	28.271	-0.00950	0.00950
-	28.314	-0.01250	0.01250	28.314	-0.00880	0.00880
-	28.358	-0.01179	0.01179	28.358	-0.00808	0.00808
-	28.402	-0.01149	0.01149	28.402	-0.00739	0.00739
-	28.445	-0.01102	0.01102	28.445	-0.00723	0.00723
-	28.489	-0.01083	0.01083	28.489	-0.00738	0.00738
-	28.532	-0.01115	0.01115	28.532	-0.00739	0.00739
-	28.576	-0.01150	0.01150	28.576	-0.00761	0.00761
-	28.620	-0.01149	0.01149	28.620	-0.00754	0.00754
-	28.663	-0.01158	0.01158	28.663	-0.00758	0.00758
-	28.707	-0.01197	0.01197	28.707	-0.00784	0.00784
-	28.751	-0.01257	0.01257	28.751	-0.00838	0.00838
-	28.794	-0.01295	0.01295	28.794	-0.00896	0.00896
-	28.838	-0.01320	0.01320	28.838	-0.00908	0.00908
34	28.838	-0.01320	0.01320	28.838	-0.00908	0.00908
-	28.881	-0.01362	0.01362	28.881	-0.00934	0.00934
-	28.925	-0.01545	0.01545	28.925	-0.01024	0.01024
-	28.969	-0.01476	0.01476	28.969	-0.00951	0.00951
-	29.012	-0.01428	0.01428	29.012	-0.00950	0.00950
-	29.056	-0.01403	0.01403	29.056	-0.00905	0.00905
-	29.099	-0.01378	0.01378	29.099	-0.00903	0.00903
-	29.143	-0.01355	0.01355	29.143	-0.00907	0.00907
-	29.187	-0.01333	0.01333	29.187	-0.00886	0.00886
-	29.230	-0.01347	0.01347	29.230	-0.00858	0.00858
-	29.274	-0.01350	0.01350	29.274	-0.00863	0.00863
-	29.318	-0.01361	0.01361	29.318	-0.00880	0.00880
-	29.361	-0.01390	0.01390	29.361	-0.00890	0.00890
-	29.405	-0.01408	0.01408	29.405	-0.00924	0.00924
-	29.448	-0.01437	0.01437	29.448	-0.00928	0.00928

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	29.492	-0.01444	0.01444	29.492	-0.00968	0.00968
-	29.536	-0.01475	0.01475	29.536	-0.00991	0.00991
-	29.579	-0.01490	0.01490	29.579	-0.01013	0.01013
-	29.623	-0.01508	0.01508	29.623	-0.01026	0.01026
-	29.667	-0.01514	0.01514	29.667	-0.01003	0.01003
-	29.710	-0.01489	0.01489	29.710	-0.00992	0.00992
35	29.710	-0.01489	0.01489	29.710	-0.00992	0.00992
-	29.754	-0.01504	0.01504	29.754	-0.01029	0.01029
-	29.797	-0.01495	0.01495	29.797	-0.01049	0.01049
-	29.841	-0.01433	0.01433	29.841	-0.00984	0.00984
-	29.885	-0.01379	0.01379	29.885	-0.00967	0.00967
-	29.928	-0.01529	0.01529	29.928	-0.01039	0.01039
-	29.972	-0.01410	0.01410	29.972	-0.00932	0.00932
-	30.015	-0.01320	0.01320	30.015	-0.00821	0.00821
-	30.059	-0.01179	0.01179	30.059	-0.00696	0.00696
-	30.103	-0.01098	0.01098	30.103	-0.00660	0.00660
-	30.146	-0.01074	0.01074	30.146	-0.00651	0.00651
-	30.190	-0.01070	0.01070	30.190	-0.00644	0.00644
-	30.234	-0.01057	0.01057	30.234	-0.00648	0.00648
-	30.277	-0.01031	0.01031	30.277	-0.00622	0.00622
-	30.321	-0.01051	0.01051	30.321	-0.00579	0.00579
-	30.364	-0.01067	0.01067	30.364	-0.00607	0.00607
-	30.408	-0.01104	0.01104	30.408	-0.00672	0.00672
-	30.452	-0.01149	0.01149	30.452	-0.00698	0.00698
-	30.495	-0.01205	0.01205	30.495	-0.00762	0.00762
-	30.539	-0.01262	0.01262	30.539	-0.00798	0.00798
-	30.582	-0.01288	0.01288	30.582	-0.00850	0.00850
36	30.582	-0.01288	0.01288	30.582	-0.00850	0.00850
-	30.626	-0.01364	0.01364	30.626	-0.00894	0.00894
-	30.670	-0.01499	0.01499	30.670	-0.01007	0.01007
-	30.713	-0.01466	0.01466	30.713	-0.00909	0.00909
-	30.757	-0.01337	0.01337	30.757	-0.00746	0.00746
-	30.801	-0.01183	0.01183	30.801	-0.00637	0.00637
-	30.844	-0.01081	0.01081	30.844	-0.00611	0.00611
-	30.888	-0.01053	0.01053	30.888	-0.00569	0.00569
-	30.931	-0.01032	0.01032	30.931	-0.00598	0.00598
-	30.975	-0.01003	0.01003	30.975	-0.00583	0.00583
-	31.019	-0.00964	0.00964	31.019	-0.00567	0.00567
-	31.062	-0.00967	0.00967	31.062	-0.00518	0.00518
-	31.106	-0.01001	0.01001	31.106	-0.00495	0.00495
-	31.150	-0.01033	0.01033	31.150	-0.00502	0.00502
-	31.193	-0.01058	0.01058	31.193	-0.00580	0.00580
-	31.237	-0.01090	0.01090	31.237	-0.00634	0.00634
-	31.280	-0.01145	0.01145	31.280	-0.00700	0.00700
-	31.324	-0.01209	0.01209	31.324	-0.00745	0.00745
-	31.368	-0.01239	0.01239	31.368	-0.00751	0.00751
-	31.411	-0.01273	0.01273	31.411	-0.00784	0.00784
-	31.455	-0.01316	0.01316	31.455	-0.00800	0.00800

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37	31.455	-0.01316	0.01316	31.455	-0.00800	0.00800
-	31.498	-0.01362	0.01362	31.498	-0.00836	0.00836
-	31.542	-0.01485	0.01485	31.542	-0.01019	0.01019
-	31.586	-0.01521	0.01521	31.586	-0.01000	0.01000
-	31.629	-0.01454	0.01454	31.629	-0.00971	0.00971
-	31.673	-0.01412	0.01412	31.673	-0.00976	0.00976
-	31.717	-0.01370	0.01370	31.717	-0.00977	0.00977
-	31.760	-0.01332	0.01332	31.760	-0.00950	0.00950
-	31.804	-0.01278	0.01278	31.804	-0.00869	0.00869
-	31.847	-0.01200	0.01200	31.847	-0.00767	0.00767
-	31.891	-0.01146	0.01146	31.891	-0.00741	0.00741
-	31.935	-0.01139	0.01139	31.935	-0.00728	0.00728
-	31.978	-0.01137	0.01137	31.978	-0.00714	0.00714
-	32.022	-0.01090	0.01090	32.022	-0.00689	0.00689
-	32.065	-0.01063	0.01063	32.065	-0.00687	0.00687
-	32.109	-0.01080	0.01080	32.109	-0.00697	0.00697
-	32.153	-0.01125	0.01125	32.153	-0.00746	0.00746
-	32.196	-0.01166	0.01166	32.196	-0.00779	0.00779
-	32.240	-0.01205	0.01205	32.240	-0.00798	0.00798
-	32.284	-0.01268	0.01268	32.284	-0.00828	0.00828
-	32.327	-0.01318	0.01318	32.327	-0.00863	0.00863
38	32.327	-0.01318	0.01318	32.327	-0.00863	0.00863
-	32.371	-0.01351	0.01351	32.371	-0.00927	0.00927
-	32.414	-0.01515	0.01515	32.414	-0.00958	0.00958
-	32.458	-0.01472	0.01472	32.458	-0.00834	0.00834
-	32.502	-0.01381	0.01381	32.502	-0.00737	0.00737
-	32.545	-0.01247	0.01247	32.545	-0.00666	0.00666
-	32.589	-0.01203	0.01203	32.589	-0.00681	0.00681
-	32.633	-0.01172	0.01172	32.633	-0.00662	0.00662
-	32.676	-0.01132	0.01132	32.676	-0.00680	0.00680
-	32.720	-0.01118	0.01118	32.720	-0.00639	0.00639
-	32.763	-0.01051	0.01051	32.763	-0.00569	0.00569
-	32.807	-0.01081	0.01081	32.807	-0.00551	0.00551
-	32.851	-0.01095	0.01095	32.851	-0.00548	0.00548
-	32.894	-0.01144	0.01144	32.894	-0.00592	0.00592
-	32.938	-0.01195	0.01195	32.938	-0.00701	0.00701
-	32.981	-0.01260	0.01260	32.981	-0.00756	0.00756
-	33.025	-0.01330	0.01330	33.025	-0.00817	0.00817
-	33.069	-0.01364	0.01364	33.069	-0.00856	0.00856
-	33.112	-0.01400	0.01400	33.112	-0.00858	0.00858
-	33.156	-0.01471	0.01471	33.156	-0.00884	0.00884
-	33.200	-0.01496	0.01496	33.200	-0.00865	0.00865
39	33.200	-0.01496	0.01496	33.200	-0.00865	0.00865
-	33.243	-0.01462	0.01462	33.243	-0.00865	0.00865
-	33.287	-0.01416	0.01416	33.287	-0.00814	0.00814
-	33.330	-0.01339	0.01339	33.330	-0.00809	0.00809
-	33.374	-0.01322	0.01322	33.374	-0.00735	0.00735
-	33.418	-0.01580	0.01580	33.418	-0.01076	0.01076

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-	33.461	-0.01450	0.01450	33.461	-0.00893	0.00893
-	33.505	-0.01296	0.01296	33.505	-0.00786	0.00786
-	33.548	-0.01177	0.01177	33.548	-0.00665	0.00665
-	33.592	-0.01032	0.01032	33.592	-0.00536	0.00536
-	33.636	-0.01000	0.01000	33.636	-0.00495	0.00495
-	33.679	-0.00974	0.00974	33.679	-0.00499	0.00499
-	33.723	-0.00993	0.00993	33.723	-0.00509	0.00509
-	33.767	-0.01051	0.01051	33.767	-0.00600	0.00600
-	33.810	-0.01080	0.01080	33.810	-0.00625	0.00625
-	33.854	-0.01151	0.01151	33.854	-0.00688	0.00688
-	33.897	-0.01184	0.01184	33.897	-0.00680	0.00680
-	33.941	-0.01219	0.01219	33.941	-0.00652	0.00652
-	33.985	-0.01250	0.01250	33.985	-0.00699	0.00699
-	34.028	-0.01278	0.01278	34.028	-0.00732	0.00732
-	34.072	-0.01291	0.01291	34.072	-0.00802	0.00802
40	34.072	-0.01291	0.01291	34.072	-0.00802	0.00802
-	34.116	-0.01292	0.01292	34.116	-0.00912	0.00912
-	34.159	-0.01473	0.01473	34.159	-0.01045	0.01045
-	34.203	-0.01437	0.01437	34.203	-0.01042	0.01042
-	34.246	-0.01457	0.01457	34.246	-0.01038	0.01038
-	34.290	-0.01381	0.01381	34.290	-0.00995	0.00995
-	34.334	-0.01381	0.01381	34.334	-0.00977	0.00977
-	34.377	-0.01372	0.01372	34.377	-0.01022	0.01022
-	34.421	-0.01369	0.01369	34.421	-0.00987	0.00987
-	34.464	-0.01375	0.01375	34.464	-0.01018	0.01018
-	34.508	-0.01338	0.01338	34.508	-0.01002	0.01002
-	34.552	-0.01357	0.01357	34.552	-0.00967	0.00967
-	34.595	-0.01354	0.01354	34.595	-0.01002	0.01002
-	34.639	-0.01383	0.01383	34.639	-0.00957	0.00957
-	34.683	-0.01381	0.01381	34.683	-0.01023	0.01023
-	34.726	-0.01410	0.01410	34.726	-0.01038	0.01038
-	34.770	-0.01433	0.01433	34.770	-0.01054	0.01054
-	34.813	-0.01440	0.01440	34.813	-0.01062	0.01062
-	34.857	-0.01413	0.01413	34.857	-0.01007	0.01007
-	34.901	-0.01393	0.01393	34.901	-0.01003	0.01003
-	34.944	-0.01337	0.01337	34.944	-0.00974	0.00974
41	34.944	-0.01337	0.01337	34.944	-0.00974	0.00974
-	34.988	-0.01350	0.01350	34.988	-0.00921	0.00921
-	35.031	-0.01412	0.01412	35.031	-0.01026	0.01026
-	35.075	-0.01426	0.01426	35.075	-0.01011	0.01011
-	35.119	-0.01398	0.01398	35.119	-0.01044	0.01044
-	35.162	-0.01595	0.01595	35.162	-0.01072	0.01072
-	35.206	-0.01532	0.01532	35.206	-0.01020	0.01020
-	35.250	-0.01438	0.01438	35.250	-0.01027	0.01027
-	35.293	-0.01319	0.01319	35.293	-0.00903	0.00903
-	35.337	-0.01222	0.01222	35.337	-0.00823	0.00823
-	35.380	-0.01132	0.01132	35.380	-0.00751	0.00751
-	35.424	-0.01107	0.01107	35.424	-0.00667	0.00667

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-	35.468	-0.01079	0.01079	35.468	-0.00689	0.00689
-	35.511	-0.01101	0.01101	35.511	-0.00672	0.00672
-	35.555	-0.01128	0.01128	35.555	-0.00727	0.00727
-	35.599	-0.01205	0.01205	35.599	-0.00763	0.00763
-	35.642	-0.01210	0.01210	35.642	-0.00746	0.00746
-	35.686	-0.01232	0.01232	35.686	-0.00785	0.00785
-	35.729	-0.01263	0.01263	35.729	-0.00801	0.00801
-	35.773	-0.01341	0.01341	35.773	-0.00882	0.00882
-	35.817	-0.01403	0.01403	35.817	-0.00928	0.00928
42	35.817	-0.01403	0.01403	35.817	-0.00928	0.00928
-	35.860	-0.01402	0.01402	35.860	-0.00977	0.00977
-	35.904	-0.01572	0.01572	35.904	-0.01037	0.01037
-	35.947	-0.01563	0.01563	35.947	-0.00974	0.00974
-	35.991	-0.01521	0.01521	35.991	-0.00927	0.00927
-	36.035	-0.01431	0.01431	36.035	-0.00865	0.00865
-	36.078	-0.01380	0.01380	36.078	-0.00856	0.00856
-	36.122	-0.01327	0.01327	36.122	-0.00849	0.00849
-	36.166	-0.01294	0.01294	36.166	-0.00851	0.00851
-	36.209	-0.01296	0.01296	36.209	-0.00847	0.00847
-	36.253	-0.01297	0.01297	36.253	-0.00826	0.00826
-	36.296	-0.01308	0.01308	36.296	-0.00783	0.00783
-	36.340	-0.01312	0.01312	36.340	-0.00791	0.00791
-	36.384	-0.01358	0.01358	36.384	-0.00818	0.00818
-	36.427	-0.01395	0.01395	36.427	-0.00871	0.00871
-	36.471	-0.01427	0.01427	36.471	-0.00915	0.00915
-	36.514	-0.01457	0.01457	36.514	-0.00955	0.00955
-	36.558	-0.01479	0.01479	36.558	-0.00965	0.00965
-	36.602	-0.01501	0.01501	36.602	-0.00986	0.00986
-	36.645	-0.01500	0.01500	36.645	-0.00988	0.00988
-	36.689	-0.01518	0.01518	36.689	-0.00979	0.00979
43	36.689	-0.01518	0.01518	36.689	-0.00979	0.00979
-	36.733	-0.01530	0.01530	36.733	-0.00977	0.00977
-	36.776	-0.01542	0.01542	36.776	-0.01003	0.01003
-	36.820	-0.01488	0.01488	36.820	-0.00970	0.00970
-	36.863	-0.01452	0.01452	36.863	-0.00953	0.00953
-	36.907	-0.01583	0.01583	36.907	-0.01157	0.01157
-	36.951	-0.01398	0.01398	36.951	-0.00881	0.00881
-	36.994	-0.01256	0.01256	36.994	-0.00750	0.00750
-	37.038	-0.01061	0.01061	37.038	-0.00598	0.00598
-	37.082	-0.01112	0.01112	37.082	-0.00706	0.00706
-	37.125	-0.01175	0.01175	37.125	-0.00653	0.00653
-	37.169	-0.01188	0.01188	37.169	-0.00670	0.00670
-	37.212	-0.01152	0.01152	37.212	-0.00675	0.00675
-	37.256	-0.01200	0.01200	37.256	-0.00878	0.00878
-	37.300	-0.01249	0.01249	37.300	-0.00931	0.00931
-	37.343	-0.01268	0.01268	37.343	-0.00936	0.00936
-	37.387	-0.01209	0.01209	37.387	-0.00862	0.00862
-	37.430	-0.01126	0.01126	37.430	-0.00740	0.00740

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-	37.474	-0.01131	0.01131	37.474	-0.00683	0.00683
-	37.518	-0.01130	0.01130	37.518	-0.00649	0.00649
-	37.561	-0.01109	0.01109	37.561	-0.00674	0.00674
44	37.561	-0.01109	0.01109	37.561	-0.00674	0.00674
-	37.605	-0.01080	0.01080	37.605	-0.00773	0.00773
-	37.649	-0.01472	0.01472	37.649	-0.01018	0.01018
-	37.692	-0.01512	0.01512	37.692	-0.01075	0.01075
-	37.736	-0.01510	0.01510	37.736	-0.01064	0.01064
-	37.779	-0.01441	0.01441	37.779	-0.01005	0.01005
-	37.823	-0.01427	0.01427	37.823	-0.00966	0.00966
-	37.867	-0.01407	0.01407	37.867	-0.01004	0.01004
-	37.910	-0.01406	0.01406	37.910	-0.00994	0.00994
-	37.954	-0.01414	0.01414	37.954	-0.01045	0.01045
-	37.997	-0.01411	0.01411	37.997	-0.01045	0.01045
-	38.041	-0.01416	0.01416	38.041	-0.01018	0.01018
-	38.085	-0.01442	0.01442	38.085	-0.01032	0.01032
-	38.128	-0.01470	0.01470	38.128	-0.00999	0.00999
-	38.172	-0.01504	0.01504	38.172	-0.01030	0.01030
-	38.216	-0.01514	0.01514	38.216	-0.01068	0.01068
-	38.259	-0.01533	0.01533	38.259	-0.01092	0.01092
-	38.303	-0.01556	0.01556	38.303	-0.01119	0.01119
-	38.346	-0.01530	0.01530	38.346	-0.01092	0.01092
-	38.390	-0.01503	0.01503	38.390	-0.01087	0.01087
-	38.434	-0.01449	0.01449	38.434	-0.01041	0.01041
45	38.434	-0.01449	0.01449	38.434	-0.01041	0.01041
-	38.477	-0.01485	0.01485	38.477	-0.01012	0.01012
-	38.521	-0.01495	0.01495	38.521	-0.01058	0.01058
-	38.565	-0.01418	0.01418	38.565	-0.01003	0.01003
-	38.608	-0.01374	0.01374	38.608	-0.00995	0.00995
-	38.652	-0.01558	0.01558	38.652	-0.01117	0.01117
-	38.695	-0.01397	0.01397	38.695	-0.00996	0.00996
-	38.739	-0.01278	0.01278	38.739	-0.00887	0.00887
-	38.783	-0.01112	0.01112	38.783	-0.00737	0.00737
-	38.826	-0.01029	0.01029	38.826	-0.00707	0.00707
-	38.870	-0.01115	0.01115	38.870	-0.00709	0.00709
-	38.913	-0.01199	0.01199	38.913	-0.00773	0.00773
-	38.957	-0.01266	0.01266	38.957	-0.00813	0.00813
-	39.001	-0.01231	0.01231	39.001	-0.00877	0.00877
-	39.044	-0.01209	0.01209	39.044	-0.00869	0.00869
-	39.088	-0.01204	0.01204	39.088	-0.00818	0.00818
-	39.132	-0.01150	0.01150	39.132	-0.00814	0.00814
-	39.175	-0.01080	0.01080	39.175	-0.00726	0.00726
-	39.219	-0.01038	0.01038	39.219	-0.00701	0.00701
-	39.262	-0.01069	0.01069	39.262	-0.00668	0.00668
-	39.306	-0.01044	0.01044	39.306	-0.00618	0.00618
46	39.306	-0.01044	0.01044	39.306	-0.00618	0.00618
-	39.350	-0.01025	0.01025	39.350	-0.00758	0.00758
-	39.393	-0.01077	0.01077	39.393	-0.00695	0.00695

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-	39.437	-0.01040	0.01040	39.437	-0.00607	0.00607
-	39.481	-0.00986	0.00986	39.481	-0.00591	0.00591
-	39.524	-0.00928	0.00928	39.524	-0.00512	0.00512
-	39.568	-0.00909	0.00909	39.568	-0.00484	0.00484
-	39.611	-0.00882	0.00882	39.611	-0.00502	0.00502
-	39.655	-0.00826	0.00826	39.655	-0.00493	0.00493
-	39.699	-0.00788	0.00788	39.699	-0.00459	0.00459
-	39.742	-0.00755	0.00755	39.742	-0.00420	0.00420
-	39.786	-0.00738	0.00738	39.786	-0.00407	0.00407
-	39.829	-0.00749	0.00749	39.829	-0.00411	0.00411
-	39.873	-0.00790	0.00790	39.873	-0.00449	0.00449
-	39.917	-0.00851	0.00851	39.917	-0.00517	0.00517
-	39.960	-0.00912	0.00912	39.960	-0.00574	0.00574
-	40.004	-0.00968	0.00968	40.004	-0.00639	0.00639
-	40.048	-0.01049	0.01049	40.048	-0.00682	0.00682
-	40.091	-0.01111	0.01111	40.091	-0.00727	0.00727
-	40.135	-0.01167	0.01167	40.135	-0.00761	0.00761
-	40.178	-0.01213	0.01213	40.178	-0.00796	0.00796
47	40.178	-0.01213	0.01213	40.178	-0.00796	0.00796
-	40.222	-0.01292	0.01292	40.222	-0.00813	0.00813
-	40.266	-0.01328	0.01328	40.266	-0.00850	0.00850
-	40.309	-0.01324	0.01324	40.309	-0.00871	0.00871
-	40.353	-0.01288	0.01288	40.353	-0.00845	0.00845
-	40.396	-0.01374	0.01374	40.396	-0.01146	0.01146
-	40.440	-0.01504	0.01504	40.440	-0.01106	0.01106
-	40.484	-0.01429	0.01429	40.484	-0.01069	0.01069
-	40.527	-0.01359	0.01359	40.527	-0.01054	0.01054
-	40.571	-0.01249	0.01249	40.571	-0.00957	0.00957
-	40.615	-0.01197	0.01197	40.615	-0.00942	0.00942
-	40.658	-0.01171	0.01171	40.658	-0.00918	0.00918
-	40.702	-0.01137	0.01137	40.702	-0.00900	0.00900
-	40.745	-0.01162	0.01162	40.745	-0.00911	0.00911
-	40.789	-0.01139	0.01139	40.789	-0.00902	0.00902
-	40.833	-0.01180	0.01180	40.833	-0.00920	0.00920
-	40.876	-0.01212	0.01212	40.876	-0.00948	0.00948
-	40.920	-0.01272	0.01272	40.920	-0.00975	0.00975
-	40.964	-0.01340	0.01340	40.964	-0.01036	0.01036
-	41.007	-0.01350	0.01350	41.007	-0.01046	0.01046
-	41.051	-0.01383	0.01383	41.051	-0.01043	0.01043
48	41.051	-0.01383	0.01383	41.051	-0.01043	0.01043
-	41.094	-0.01388	0.01388	41.094	-0.01082	0.01082
-	41.138	-0.01582	0.01582	41.138	-0.01137	0.01137
-	41.182	-0.01503	0.01503	41.182	-0.01038	0.01038
-	41.225	-0.01436	0.01436	41.225	-0.00980	0.00980
-	41.269	-0.01310	0.01310	41.269	-0.00897	0.00897
-	41.312	-0.01269	0.01269	41.312	-0.00848	0.00848
-	41.356	-0.01197	0.01197	41.356	-0.00820	0.00820
-	41.400	-0.01160	0.01160	41.400	-0.00835	0.00835

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-	41.443	-0.01150	0.01150	41.443	-0.00790	0.00790
-	41.487	-0.01127	0.01127	41.487	-0.00759	0.00759
-	41.531	-0.01143	0.01143	41.531	-0.00761	0.00761
-	41.574	-0.01165	0.01165	41.574	-0.00791	0.00791
-	41.618	-0.01220	0.01220	41.618	-0.00826	0.00826
-	41.661	-0.01265	0.01265	41.661	-0.00870	0.00870
-	41.705	-0.01306	0.01306	41.705	-0.00930	0.00930
-	41.749	-0.01392	0.01392	41.749	-0.01002	0.01002
-	41.792	-0.01462	0.01462	41.792	-0.01083	0.01083
-	41.836	-0.01542	0.01542	41.836	-0.01129	0.01129
-	41.879	-0.01554	0.01554	41.879	-0.01128	0.01128
-	41.923	-0.01537	0.01537	41.923	-0.01125	0.01125
49	41.923	-0.01537	0.01537	41.923	-0.01125	0.01125
-	41.967	-0.01543	0.01543	41.967	-0.01087	0.01087
-	42.010	-0.01493	0.01493	42.010	-0.01106	0.01106
-	42.054	-0.01456	0.01456	42.054	-0.01060	0.01060
-	42.098	-0.01409	0.01409	42.098	-0.01031	0.01031
-	42.141	-0.01524	0.01524	42.141	-0.01130	0.01130
-	42.185	-0.01514	0.01514	42.185	-0.01095	0.01095
-	42.228	-0.01445	0.01445	42.228	-0.01027	0.01027
-	42.272	-0.01322	0.01322	42.272	-0.00978	0.00978
-	42.316	-0.01303	0.01303	42.316	-0.00908	0.00908
-	42.359	-0.01340	0.01340	42.359	-0.00922	0.00922
-	42.403	-0.01350	0.01350	42.403	-0.00962	0.00962
-	42.447	-0.01351	0.01351	42.447	-0.00991	0.00991
-	42.490	-0.01414	0.01414	42.490	-0.01071	0.01071
-	42.534	-0.01444	0.01444	42.534	-0.01067	0.01067
-	42.577	-0.01436	0.01436	42.577	-0.01065	0.01065
-	42.621	-0.01378	0.01378	42.621	-0.01020	0.01020
-	42.665	-0.01352	0.01352	42.665	-0.00960	0.00960
-	42.708	-0.01345	0.01345	42.708	-0.00947	0.00947
-	42.752	-0.01337	0.01337	42.752	-0.00952	0.00952
-	42.795	-0.01313	0.01313	42.795	-0.00995	0.00995
50	42.795	-0.01313	0.01313	42.795	-0.00995	0.00995
-	42.839	-0.01320	0.01320	42.839	-0.01003	0.01003
-	42.883	-0.01579	0.01579	42.883	-0.01175	0.01175
-	42.926	-0.01461	0.01461	42.926	-0.00941	0.00941
-	42.970	-0.01352	0.01352	42.970	-0.00853	0.00853
-	43.014	-0.01217	0.01217	43.014	-0.00707	0.00707
-	43.057	-0.01153	0.01153	43.057	-0.00686	0.00686
-	43.101	-0.01036	0.01036	43.101	-0.00595	0.00595
-	43.144	-0.00947	0.00947	43.144	-0.00599	0.00599
-	43.188	-0.00898	0.00898	43.188	-0.00573	0.00573
-	43.232	-0.00854	0.00854	43.232	-0.00487	0.00487
-	43.275	-0.00823	0.00823	43.275	-0.00456	0.00456
-	43.319	-0.00809	0.00809	43.319	-0.00411	0.00411
-	43.362	-0.00840	0.00840	43.362	-0.00436	0.00436
-	43.406	-0.00927	0.00927	43.406	-0.00511	0.00511

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-	43.450	-0.01003	0.01003	43.450	-0.00589	0.00589
-	43.493	-0.01041	0.01041	43.493	-0.00666	0.00666
-	43.537	-0.01097	0.01097	43.537	-0.00712	0.00712
-	43.581	-0.01183	0.01183	43.581	-0.00732	0.00732
-	43.624	-0.01254	0.01254	43.624	-0.00789	0.00789
-	43.668	-0.01266	0.01266	43.668	-0.00817	0.00817
51	43.668	-0.01266	0.01266	43.668	-0.00817	0.00817
-	43.711	-0.01277	0.01277	43.711	-0.00880	0.00880
-	43.755	-0.01403	0.01403	43.755	-0.01036	0.01036
-	43.799	-0.01508	0.01508	43.799	-0.01089	0.01089
-	43.842	-0.01582	0.01582	43.842	-0.01118	0.01118
-	43.886	-0.01580	0.01580	43.886	-0.01135	0.01135
-	43.930	-0.01489	0.01489	43.930	-0.01082	0.01082
-	43.973	-0.01431	0.01431	43.973	-0.01028	0.01028
-	44.017	-0.01328	0.01328	44.017	-0.00934	0.00934
-	44.060	-0.01258	0.01258	44.060	-0.00860	0.00860
-	44.104	-0.01216	0.01216	44.104	-0.00832	0.00832
-	44.148	-0.01186	0.01186	44.148	-0.00805	0.00805
-	44.191	-0.01207	0.01207	44.191	-0.00824	0.00824
-	44.235	-0.01191	0.01191	44.235	-0.00812	0.00812
-	44.278	-0.01194	0.01194	44.278	-0.00766	0.00766
-	44.322	-0.01172	0.01172	44.322	-0.00778	0.00778
-	44.366	-0.01217	0.01217	44.366	-0.00809	0.00809
-	44.409	-0.01278	0.01278	44.409	-0.00863	0.00863
-	44.453	-0.01323	0.01323	44.453	-0.00915	0.00915
-	44.497	-0.01337	0.01337	44.497	-0.00960	0.00960
-	44.540	-0.01374	0.01374	44.540	-0.00971	0.00971
52	44.540	-0.01374	0.01374	44.540	-0.00971	0.00971
-	44.584	-0.01419	0.01419	44.584	-0.01020	0.01020
-	44.627	-0.01549	0.01549	44.627	-0.01122	0.01122
-	44.671	-0.01459	0.01459	44.671	-0.01000	0.01000
-	44.715	-0.01420	0.01420	44.715	-0.00944	0.00944
-	44.758	-0.01332	0.01332	44.758	-0.00889	0.00889
-	44.802	-0.01329	0.01329	44.802	-0.00912	0.00912
-	44.845	-0.01265	0.01265	44.845	-0.00900	0.00900
-	44.889	-0.01262	0.01262	44.889	-0.00922	0.00922
-	44.933	-0.01269	0.01269	44.933	-0.00931	0.00931
-	44.976	-0.01296	0.01296	44.976	-0.00913	0.00913
-	45.020	-0.01307	0.01307	45.020	-0.00905	0.00905
-	45.064	-0.01300	0.01300	45.064	-0.00911	0.00911
-	45.107	-0.01355	0.01355	45.107	-0.00972	0.00972
-	45.151	-0.01401	0.01401	45.151	-0.00997	0.00997
-	45.194	-0.01429	0.01429	45.194	-0.01053	0.01053
-	45.238	-0.01456	0.01456	45.238	-0.01082	0.01082
-	45.282	-0.01476	0.01476	45.282	-0.01097	0.01097
-	45.325	-0.01527	0.01527	45.325	-0.01117	0.01117
-	45.369	-0.01515	0.01515	45.369	-0.01091	0.01091
-	45.413	-0.01516	0.01516	45.413	-0.01084	0.01084

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53	45.413	-0.01516	0.01516	45.413	-0.01084	0.01084
-	45.456	-0.01548	0.01548	45.456	-0.01113	0.01113
-	45.500	-0.01551	0.01551	45.500	-0.01121	0.01121
-	45.543	-0.01506	0.01506	45.543	-0.01103	0.01103
-	45.587	-0.01491	0.01491	45.587	-0.01079	0.01079
-	45.631	-0.01581	0.01581	45.631	-0.01187	0.01187
-	45.674	-0.01431	0.01431	45.674	-0.00900	0.00900
-	45.718	-0.01202	0.01202	45.718	-0.00653	0.00653
-	45.761	-0.00980	0.00980	45.761	-0.00479	0.00479
-	45.805	-0.00935	0.00935	45.805	-0.00465	0.00465
-	45.849	-0.00945	0.00945	45.849	-0.00427	0.00427
-	45.892	-0.00926	0.00926	45.892	-0.00382	0.00382
-	45.936	-0.00830	0.00830	45.936	-0.00337	0.00337
-	45.980	-0.00842	0.00842	45.980	-0.00423	0.00423
-	46.023	-0.00915	0.00915	46.023	-0.00503	0.00503
-	46.067	-0.00943	0.00943	46.067	-0.00548	0.00548
-	46.110	-0.00937	0.00937	46.110	-0.00533	0.00533
-	46.154	-0.00894	0.00894	46.154	-0.00481	0.00481
-	46.198	-0.00909	0.00909	46.198	-0.00426	0.00426
-	46.241	-0.00941	0.00941	46.241	-0.00401	0.00401
-	46.285	-0.00907	0.00907	46.285	-0.00406	0.00406
54	46.285	-0.00907	0.00907	46.285	-0.00406	0.00406
-	46.328	-0.00927	0.00927	46.328	-0.00575	0.00575
-	46.372	-0.01553	0.01553	46.372	-0.01179	0.01179
-	46.416	-0.01544	0.01544	46.416	-0.01039	0.01039
-	46.459	-0.01557	0.01557	46.459	-0.01015	0.01015
-	46.503	-0.01432	0.01432	46.503	-0.00950	0.00950
-	46.547	-0.01396	0.01396	46.547	-0.00902	0.00902
-	46.590	-0.01391	0.01391	46.590	-0.00938	0.00938
-	46.634	-0.01369	0.01369	46.634	-0.00898	0.00898
-	46.677	-0.01339	0.01339	46.677	-0.00946	0.00946
-	46.721	-0.01317	0.01317	46.721	-0.00927	0.00927
-	46.765	-0.01353	0.01353	46.765	-0.00891	0.00891
-	46.808	-0.01377	0.01377	46.808	-0.00921	0.00921
-	46.852	-0.01386	0.01386	46.852	-0.00885	0.00885
-	46.896	-0.01412	0.01412	46.896	-0.00961	0.00961
-	46.939	-0.01493	0.01493	46.939	-0.01001	0.01001
-	46.983	-0.01543	0.01543	46.983	-0.01065	0.01065
-	47.026	-0.01571	0.01571	47.026	-0.01126	0.01126
-	47.070	-0.01547	0.01547	47.070	-0.01077	0.01077
-	47.114	-0.01555	0.01555	47.114	-0.01070	0.01070
-	47.157	-0.01521	0.01521	47.157	-0.01039	0.01039
55	47.157	-0.01521	0.01521	47.157	-0.01039	0.01039
-	47.201	-0.01510	0.01510	47.201	-0.00957	0.00957
-	47.244	-0.01525	0.01525	47.244	-0.01033	0.01033
-	47.288	-0.01458	0.01458	47.288	-0.00978	0.00978
-	47.332	-0.01414	0.01414	47.332	-0.00957	0.00957
-	47.375	-0.01592	0.01592	47.375	-0.01177	0.01177

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-	47.419	-0.01473	0.01473	47.419	-0.01048	0.01048
-	47.463	-0.01405	0.01405	47.463	-0.00933	0.00933
-	47.506	-0.01263	0.01263	47.506	-0.00820	0.00820
-	47.550	-0.01145	0.01145	47.550	-0.00753	0.00753
-	47.593	-0.01174	0.01174	47.593	-0.00742	0.00742
-	47.637	-0.01114	0.01114	47.637	-0.00715	0.00715
-	47.681	-0.01109	0.01109	47.681	-0.00712	0.00712
-	47.724	-0.01030	0.01030	47.724	-0.00699	0.00699
-	47.768	-0.00959	0.00959	47.768	-0.00658	0.00658
-	47.811	-0.00906	0.00906	47.811	-0.00630	0.00630
-	47.855	-0.00843	0.00843	47.855	-0.00556	0.00556
-	47.899	-0.00842	0.00842	47.899	-0.00493	0.00493
-	47.942	-0.00835	0.00835	47.942	-0.00485	0.00485
-	47.986	-0.00891	0.00891	47.986	-0.00493	0.00493
-	48.030	-0.00948	0.00948	48.030	-0.00583	0.00583
56	48.030	-0.00948	0.00948	48.030	-0.00583	0.00583
-	48.073	-0.01016	0.01016	48.073	-0.00754	0.00754
-	48.117	-0.01207	0.01207	48.117	-0.00979	0.00979
-	48.160	-0.01406	0.01406	48.160	-0.01049	0.01049
-	48.204	-0.01350	0.01350	48.204	-0.01052	0.01052
-	48.248	-0.01263	0.01263	48.248	-0.00938	0.00938
-	48.291	-0.01201	0.01201	48.291	-0.00830	0.00830
-	48.335	-0.01144	0.01144	48.335	-0.00815	0.00815
-	48.379	-0.01113	0.01113	48.379	-0.00752	0.00752
-	48.422	-0.01036	0.01036	48.422	-0.00717	0.00717
-	48.466	-0.00981	0.00981	48.466	-0.00655	0.00655
-	48.509	-0.00923	0.00923	48.509	-0.00634	0.00634
-	48.553	-0.00918	0.00918	48.553	-0.00617	0.00617
-	48.597	-0.00926	0.00926	48.597	-0.00617	0.00617
-	48.640	-0.00927	0.00927	48.640	-0.00664	0.00664
-	48.684	-0.00971	0.00971	48.684	-0.00665	0.00665
-	48.727	-0.01014	0.01014	48.727	-0.00695	0.00695
-	48.771	-0.01059	0.01059	48.771	-0.00724	0.00724
-	48.815	-0.01110	0.01110	48.815	-0.00765	0.00765
-	48.858	-0.01185	0.01185	48.858	-0.00840	0.00840
-	48.902	-0.01250	0.01250	48.902	-0.00891	0.00891
57	48.902	-0.01250	0.01250	48.902	-0.00891	0.00891
-	48.946	-0.01301	0.01301	48.946	-0.00946	0.00946
-	48.989	-0.01346	0.01346	48.989	-0.01012	0.01012
-	49.033	-0.01379	0.01379	49.033	-0.01026	0.01026
-	49.076	-0.01394	0.01394	49.076	-0.01034	0.01034
-	49.120	-0.01565	0.01565	49.120	-0.01136	0.01136
-	49.164	-0.01514	0.01514	49.164	-0.01092	0.01092
-	49.207	-0.01438	0.01438	49.207	-0.01027	0.01027
-	49.251	-0.01373	0.01373	49.251	-0.00950	0.00950
-	49.294	-0.01297	0.01297	49.294	-0.00905	0.00905
-	49.338	-0.01278	0.01278	49.338	-0.00925	0.00925
-	49.382	-0.01292	0.01292	49.382	-0.00921	0.00921

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	49.425	-0.01263	0.01263	49.425	-0.00903	0.00903
-	49.469	-0.01246	0.01246	49.469	-0.00868	0.00868
-	49.513	-0.01225	0.01225	49.513	-0.00872	0.00872
-	49.556	-0.01279	0.01279	49.556	-0.00877	0.00877
-	49.600	-0.01298	0.01298	49.600	-0.00889	0.00889
-	49.643	-0.01333	0.01333	49.643	-0.00932	0.00932
-	49.687	-0.01342	0.01342	49.687	-0.00947	0.00947
-	49.731	-0.01362	0.01362	49.731	-0.00978	0.00978
-	49.774	-0.01402	0.01402	49.774	-0.01028	0.01028
58	49.774	-0.01402	0.01402	49.774	-0.01028	0.01028
-	49.818	-0.01445	0.01445	49.818	-0.01072	0.01072
-	49.862	-0.01603	0.01603	49.862	-0.01199	0.01199
-	49.905	-0.01566	0.01566	49.905	-0.01169	0.01169
-	49.949	-0.01545	0.01545	49.949	-0.01149	0.01149
-	49.992	-0.01530	0.01530	49.992	-0.01096	0.01096
-	50.036	-0.01459	0.01459	50.036	-0.01060	0.01060
-	50.080	-0.01412	0.01412	50.080	-0.01018	0.01018
-	50.123	-0.01332	0.01332	50.123	-0.00988	0.00988
-	50.167	-0.01320	0.01320	50.167	-0.00931	0.00931
-	50.210	-0.01295	0.01295	50.210	-0.00916	0.00916
-	50.254	-0.01311	0.01311	50.254	-0.00900	0.00900
-	50.298	-0.01328	0.01328	50.298	-0.00933	0.00933
-	50.341	-0.01335	0.01335	50.341	-0.00933	0.00933
-	50.385	-0.01357	0.01357	50.385	-0.00944	0.00944
-	50.429	-0.01353	0.01353	50.429	-0.00951	0.00951
-	50.472	-0.01378	0.01378	50.472	-0.00964	0.00964
-	50.516	-0.01405	0.01405	50.516	-0.01024	0.01024
-	50.559	-0.01448	0.01448	50.559	-0.01043	0.01043
-	50.603	-0.01485	0.01485	50.603	-0.01096	0.01096
-	50.647	-0.01531	0.01531	50.647	-0.01116	0.01116
59	50.647	-0.01531	0.01531	50.647	-0.01116	0.01116
-	50.690	-0.01549	0.01549	50.690	-0.01118	0.01118
-	50.734	-0.01554	0.01554	50.734	-0.01137	0.01137
-	50.777	-0.01528	0.01528	50.777	-0.01067	0.01067
-	50.821	-0.01488	0.01488	50.821	-0.01058	0.01058
-	50.865	-0.01535	0.01535	50.865	-0.01060	0.01060
-	50.908	-0.01506	0.01506	50.908	-0.01095	0.01095
-	50.952	-0.01463	0.01463	50.952	-0.01080	0.01080
-	50.996	-0.01412	0.01412	50.996	-0.01004	0.01004
-	51.039	-0.01327	0.01327	51.039	-0.00950	0.00950
-	51.083	-0.01336	0.01336	51.083	-0.00874	0.00874
-	51.126	-0.01305	0.01305	51.126	-0.00859	0.00859
-	51.170	-0.01312	0.01312	51.170	-0.00860	0.00860
-	51.214	-0.01313	0.01313	51.214	-0.00914	0.00914
-	51.257	-0.01346	0.01346	51.257	-0.00969	0.00969
-	51.301	-0.01400	0.01400	51.301	-0.01008	0.01008
-	51.345	-0.01408	0.01408	51.345	-0.01020	0.01020
-	51.388	-0.01440	0.01440	51.388	-0.00986	0.00986

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-	51.432	-0.01434	0.01434	51.432	-0.00985	0.00985
-	51.475	-0.01431	0.01431	51.475	-0.00984	0.00984
-	51.519	-0.01427	0.01427	51.519	-0.00984	0.00984
60	51.519	-0.01427	0.01427	51.519	-0.00984	0.00984
-	51.563	-0.01389	0.01389	51.563	-0.01053	0.01053
-	51.606	-0.01418	0.01418	51.606	-0.00983	0.00983
-	51.650	-0.01247	0.01247	51.650	-0.00842	0.00842
-	51.693	-0.01160	0.01160	51.693	-0.00764	0.00764
-	51.737	-0.01085	0.01085	51.737	-0.00664	0.00664
-	51.781	-0.01037	0.01037	51.781	-0.00632	0.00632
-	51.824	-0.00969	0.00969	51.824	-0.00613	0.00613
-	51.868	-0.00915	0.00915	51.868	-0.00576	0.00576
-	51.912	-0.00915	0.00915	51.912	-0.00557	0.00557
-	51.955	-0.00904	0.00904	51.955	-0.00566	0.00566
-	51.999	-0.00929	0.00929	51.999	-0.00581	0.00581
-	52.042	-0.01000	0.01000	52.042	-0.00610	0.00610
-	52.086	-0.01040	0.01040	52.086	-0.00666	0.00666
-	52.130	-0.01121	0.01121	52.130	-0.00718	0.00718
-	52.173	-0.01182	0.01182	52.173	-0.00769	0.00769
-	52.217	-0.01257	0.01257	52.217	-0.00855	0.00855
-	52.261	-0.01318	0.01318	52.261	-0.00914	0.00914
-	52.304	-0.01372	0.01372	52.304	-0.00964	0.00964
-	52.348	-0.01420	0.01420	52.348	-0.00995	0.00995
-	52.391	-0.01429	0.01429	52.391	-0.01011	0.01011
61	52.391	-0.01429	0.01429	52.391	-0.01011	0.01011
-	52.435	-0.01479	0.01479	52.435	-0.01024	0.01024
-	52.479	-0.01459	0.01459	52.479	-0.01071	0.01071
-	52.522	-0.01413	0.01413	52.522	-0.01031	0.01031
-	52.566	-0.01402	0.01402	52.566	-0.00954	0.00954
-	52.609	-0.01509	0.01509	52.609	-0.01121	0.01121
-	52.653	-0.01555	0.01555	52.653	-0.01196	0.01196
-	52.697	-0.01421	0.01421	52.697	-0.01127	0.01127
-	52.740	-0.01323	0.01323	52.740	-0.01002	0.01002
-	52.784	-0.01209	0.01209	52.784	-0.00884	0.00884
-	52.828	-0.01149	0.01149	52.828	-0.00777	0.00777
-	52.871	-0.01079	0.01079	52.871	-0.00715	0.00715
-	52.915	-0.01060	0.01060	52.915	-0.00711	0.00711
-	52.958	-0.01075	0.01075	52.958	-0.00748	0.00748
-	53.002	-0.01135	0.01135	53.002	-0.00802	0.00802
-	53.046	-0.01205	0.01205	53.046	-0.00859	0.00859
-	53.089	-0.01226	0.01226	53.089	-0.00850	0.00850
-	53.133	-0.01273	0.01273	53.133	-0.00859	0.00859
-	53.176	-0.01300	0.01300	53.176	-0.00889	0.00889
-	53.220	-0.01358	0.01358	53.220	-0.00932	0.00932
-	53.264	-0.01387	0.01387	53.264	-0.00999	0.00999
62	53.264	-0.01387	0.01387	53.264	-0.00999	0.00999
-	53.307	-0.01396	0.01396	53.307	-0.01072	0.01072
-	53.351	-0.01543	0.01543	53.351	-0.01137	0.01137

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-	53.395	-0.01514	0.01514	53.395	-0.01163	0.01163
-	53.438	-0.01515	0.01515	53.438	-0.01144	0.01144
-	53.482	-0.01476	0.01476	53.482	-0.01081	0.01081
-	53.525	-0.01442	0.01442	53.525	-0.01005	0.01005
-	53.569	-0.01392	0.01392	53.569	-0.00990	0.00990
-	53.613	-0.01327	0.01327	53.613	-0.00975	0.00975
-	53.656	-0.01323	0.01323	53.656	-0.00968	0.00968
-	53.700	-0.01314	0.01314	53.700	-0.00991	0.00991
-	53.744	-0.01314	0.01314	53.744	-0.00963	0.00963
-	53.787	-0.01301	0.01301	53.787	-0.00969	0.00969
-	53.831	-0.01322	0.01322	53.831	-0.00948	0.00948
-	53.874	-0.01369	0.01369	53.874	-0.00964	0.00964
-	53.918	-0.01410	0.01410	53.918	-0.01022	0.01022
-	53.962	-0.01446	0.01446	53.962	-0.01041	0.01041
-	54.005	-0.01444	0.01444	54.005	-0.01061	0.01061
-	54.049	-0.01467	0.01467	54.049	-0.01058	0.01058
-	54.092	-0.01447	0.01447	54.092	-0.01055	0.01055
-	54.136	-0.01441	0.01441	54.136	-0.01078	0.01078
63	54.136	-0.01441	0.01441	54.136	-0.01078	0.01078
-	54.180	-0.01463	0.01463	54.180	-0.01066	0.01066
-	54.223	-0.01464	0.01464	54.223	-0.01100	0.01100
-	54.267	-0.01422	0.01422	54.267	-0.01050	0.01050
-	54.311	-0.01431	0.01431	54.311	-0.01049	0.01049
-	54.354	-0.01433	0.01433	54.354	-0.01082	0.01082
-	54.398	-0.01422	0.01422	54.398	-0.01064	0.01064
-	54.441	-0.01422	0.01422	54.441	-0.01082	0.01082
-	54.485	-0.01401	0.01401	54.485	-0.01060	0.01060
-	54.529	-0.01414	0.01414	54.529	-0.01071	0.01071
-	54.572	-0.01430	0.01430	54.572	-0.01081	0.01081
-	54.616	-0.01453	0.01453	54.616	-0.01081	0.01081
-	54.659	-0.01478	0.01478	54.659	-0.01113	0.01113
-	54.703	-0.01480	0.01480	54.703	-0.01120	0.01120
-	54.747	-0.01504	0.01504	54.747	-0.01132	0.01132
-	54.790	-0.01519	0.01519	54.790	-0.01161	0.01161
-	54.834	-0.01522	0.01522	54.834	-0.01147	0.01147
-	54.878	-0.01522	0.01522	54.878	-0.01150	0.01150
-	54.921	-0.01496	0.01496	54.921	-0.01145	0.01145
-	54.965	-0.01488	0.01488	54.965	-0.01111	0.01111
-	55.008	-0.01453	0.01453	55.008	-0.01081	0.01081
64	55.008	-0.01453	0.01453	55.008	-0.01081	0.01081
-	55.052	-0.01409	0.01409	55.052	-0.01037	0.01037
-	55.096	-0.01477	0.01477	55.096	-0.01100	0.01100
-	55.139	-0.01497	0.01497	55.139	-0.01128	0.01128
-	55.183	-0.01506	0.01506	55.183	-0.01135	0.01135
-	55.227	-0.01490	0.01490	55.227	-0.01127	0.01127
-	55.270	-0.01474	0.01474	55.270	-0.01067	0.01067
-	55.314	-0.01462	0.01462	55.314	-0.01071	0.01071
-	55.357	-0.01434	0.01434	55.357	-0.01066	0.01066

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-	55.401	-0.01436	0.01436	55.401	-0.01096	0.01096
-	55.445	-0.01457	0.01457	55.445	-0.01136	0.01136
-	55.488	-0.01455	0.01455	55.488	-0.01092	0.01092
-	55.532	-0.01432	0.01432	55.532	-0.01076	0.01076
-	55.575	-0.01395	0.01395	55.575	-0.01045	0.01045
-	55.619	-0.01417	0.01417	55.619	-0.01036	0.01036
-	55.663	-0.01458	0.01458	55.663	-0.01084	0.01084
-	55.706	-0.01470	0.01470	55.706	-0.01101	0.01101
-	55.750	-0.01449	0.01449	55.750	-0.01117	0.01117
-	55.794	-0.01451	0.01451	55.794	-0.01111	0.01111
-	55.837	-0.01447	0.01447	55.837	-0.01084	0.01084
-	55.881	-0.01452	0.01452	55.881	-0.01093	0.01093
65	55.881	-0.01452	0.01452	55.881	-0.01093	0.01093
-	55.924	-0.01498	0.01498	55.924	-0.01107	0.01107
-	55.968	-0.01525	0.01525	55.968	-0.01141	0.01141
-	56.012	-0.01490	0.01490	56.012	-0.01113	0.01113
-	56.055	-0.01454	0.01454	56.055	-0.01121	0.01121
-	56.099	-0.01585	0.01585	56.099	-0.01201	0.01201
-	56.142	-0.01532	0.01532	56.142	-0.01106	0.01106
-	56.186	-0.01461	0.01461	56.186	-0.01040	0.01040
-	56.230	-0.01383	0.01383	56.230	-0.00964	0.00964
-	56.273	-0.01303	0.01303	56.273	-0.00931	0.00931
-	56.317	-0.01243	0.01243	56.317	-0.00918	0.00918
-	56.361	-0.01194	0.01194	56.361	-0.00859	0.00859
-	56.404	-0.01177	0.01177	56.404	-0.00857	0.00857
-	56.448	-0.01167	0.01167	56.448	-0.00828	0.00828
-	56.491	-0.01172	0.01172	56.491	-0.00800	0.00800
-	56.535	-0.01178	0.01178	56.535	-0.00836	0.00836
-	56.579	-0.01233	0.01233	56.579	-0.00849	0.00849
-	56.622	-0.01280	0.01280	56.622	-0.00895	0.00895
-	56.666	-0.01316	0.01316	56.666	-0.00936	0.00936
-	56.710	-0.01340	0.01340	56.710	-0.00973	0.00973
-	56.753	-0.01398	0.01398	56.753	-0.01048	0.01048
66	56.753	-0.01398	0.01398	56.753	-0.01048	0.01048
-	56.797	-0.01478	0.01478	56.797	-0.01108	0.01108
-	56.840	-0.01606	0.01606	56.840	-0.01196	0.01196
-	56.884	-0.01556	0.01556	56.884	-0.01119	0.01119
-	56.928	-0.01494	0.01494	56.928	-0.01070	0.01070
-	56.971	-0.01426	0.01426	56.971	-0.00999	0.00999
-	57.015	-0.01371	0.01371	57.015	-0.01000	0.01000
-	57.058	-0.01341	0.01341	57.058	-0.00979	0.00979
-	57.102	-0.01319	0.01319	57.102	-0.00962	0.00962
-	57.146	-0.01297	0.01297	57.146	-0.00943	0.00943
-	57.189	-0.01303	0.01303	57.189	-0.00924	0.00924
-	57.233	-0.01350	0.01350	57.233	-0.00943	0.00943
-	57.277	-0.01411	0.01411	57.277	-0.00966	0.00966
-	57.320	-0.01422	0.01422	57.320	-0.00998	0.00998
-	57.364	-0.01466	0.01466	57.364	-0.01044	0.01044

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-	57.407	-0.01518	0.01518	57.407	-0.01090	0.01090
-	57.451	-0.01519	0.01519	57.451	-0.01145	0.01145
-	57.495	-0.01525	0.01525	57.495	-0.01156	0.01156
-	57.538	-0.01552	0.01552	57.538	-0.01152	0.01152
-	57.582	-0.01543	0.01543	57.582	-0.01121	0.01121
-	57.625	-0.01473	0.01473	57.625	-0.01073	0.01073
67	57.625	-0.01473	0.01473	57.625	-0.01073	0.01073
-	57.669	-0.01466	0.01466	57.669	-0.01027	0.01027
-	57.713	-0.01486	0.01486	57.713	-0.01072	0.01072
-	57.756	-0.01456	0.01456	57.756	-0.01054	0.01054
-	57.800	-0.01424	0.01424	57.800	-0.01103	0.01103
-	57.844	-0.01532	0.01532	57.844	-0.01129	0.01129
-	57.887	-0.01567	0.01567	57.887	-0.01125	0.01125
-	57.931	-0.01532	0.01532	57.931	-0.01106	0.01106
-	57.974	-0.01475	0.01475	57.974	-0.01069	0.01069
-	58.018	-0.01394	0.01394	58.018	-0.00976	0.00976
-	58.062	-0.01346	0.01346	58.062	-0.00962	0.00962
-	58.105	-0.01305	0.01305	58.105	-0.00939	0.00939
-	58.149	-0.01307	0.01307	58.149	-0.00930	0.00930
-	58.193	-0.01304	0.01304	58.193	-0.00954	0.00954
-	58.236	-0.01306	0.01306	58.236	-0.00940	0.00940
-	58.280	-0.01352	0.01352	58.280	-0.00955	0.00955
-	58.323	-0.01382	0.01382	58.323	-0.00980	0.00980
-	58.367	-0.01432	0.01432	58.367	-0.01016	0.01016
-	58.411	-0.01428	0.01428	58.411	-0.01020	0.01020
-	58.454	-0.01478	0.01478	58.454	-0.01048	0.01048
-	58.498	-0.01512	0.01512	58.498	-0.01083	0.01083
68	58.498	-0.01512	0.01512	58.498	-0.01083	0.01083
-	58.541	-0.01498	0.01498	58.541	-0.01131	0.01131
-	58.585	-0.01562	0.01562	58.585	-0.01160	0.01160
-	58.629	-0.01509	0.01509	58.629	-0.01083	0.01083
-	58.672	-0.01481	0.01481	58.672	-0.01070	0.01070
-	58.716	-0.01426	0.01426	58.716	-0.01031	0.01031
-	58.760	-0.01414	0.01414	58.760	-0.01063	0.01063
-	58.803	-0.01410	0.01410	58.803	-0.01082	0.01082
-	58.847	-0.01408	0.01408	58.847	-0.01077	0.01077
-	58.890	-0.01416	0.01416	58.890	-0.01081	0.01081
-	58.934	-0.01414	0.01414	58.934	-0.01038	0.01038
-	58.978	-0.01425	0.01425	58.978	-0.01037	0.01037
-	59.021	-0.01450	0.01450	59.021	-0.01055	0.01055
-	59.065	-0.01484	0.01484	59.065	-0.01099	0.01099
-	59.108	-0.01525	0.01525	59.108	-0.01153	0.01153
-	59.152	-0.01529	0.01529	59.152	-0.01158	0.01158
-	59.196	-0.01549	0.01549	59.196	-0.01166	0.01166
-	59.239	-0.01545	0.01545	59.239	-0.01162	0.01162
-	59.283	-0.01548	0.01548	59.283	-0.01162	0.01162
-	59.327	-0.01515	0.01515	59.327	-0.01129	0.01129
-	59.370	-0.01519	0.01519	59.370	-0.01123	0.01123

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69	59.370	-0.01519	0.01519	59.370	-0.01123	0.01123
-	59.414	-0.01501	0.01501	59.414	-0.01143	0.01143
-	59.457	-0.01488	0.01488	59.457	-0.01159	0.01159
-	59.501	-0.01495	0.01495	59.501	-0.01146	0.01146
-	59.545	-0.01490	0.01490	59.545	-0.01103	0.01103
-	59.588	-0.01531	0.01531	59.588	-0.01187	0.01187
-	59.632	-0.01557	0.01557	59.632	-0.01176	0.01176
-	59.676	-0.01526	0.01526	59.676	-0.01092	0.01092
-	59.719	-0.01408	0.01408	59.719	-0.01032	0.01032
-	59.763	-0.01306	0.01306	59.763	-0.00933	0.00933
-	59.806	-0.01316	0.01316	59.806	-0.00943	0.00943
-	59.850	-0.01350	0.01350	59.850	-0.00976	0.00976
-	59.894	-0.01345	0.01345	59.894	-0.00996	0.00996
-	59.937	-0.01362	0.01362	59.937	-0.01001	0.01001
-	59.981	-0.01320	0.01320	59.981	-0.00945	0.00945
-	60.024	-0.01310	0.01310	60.024	-0.00971	0.00971
-	60.068	-0.01328	0.01328	60.068	-0.00978	0.00978
-	60.112	-0.01358	0.01358	60.112	-0.00995	0.00995
-	60.155	-0.01387	0.01387	60.155	-0.01033	0.01033
-	60.199	-0.01383	0.01383	60.199	-0.01038	0.01038
-	60.243	-0.01409	0.01409	60.243	-0.01018	0.01018
70	60.243	-0.01409	0.01409	60.243	-0.01018	0.01018
-	60.286	-0.01399	0.01399	60.286	-0.01034	0.01034
-	60.330	-0.01553	0.01553	60.330	-0.01110	0.01110
-	60.373	-0.01560	0.01560	60.373	-0.01148	0.01148
-	60.417	-0.01513	0.01513	60.417	-0.01090	0.01090
-	60.461	-0.01428	0.01428	60.461	-0.01053	0.01053
-	60.504	-0.01400	0.01400	60.504	-0.00976	0.00976
-	60.548	-0.01360	0.01360	60.548	-0.00984	0.00984
-	60.591	-0.01296	0.01296	60.591	-0.00947	0.00947
-	60.635	-0.01294	0.01294	60.635	-0.00949	0.00949
-	60.679	-0.01309	0.01309	60.679	-0.00976	0.00976
-	60.722	-0.01343	0.01343	60.722	-0.00960	0.00960
-	60.766	-0.01366	0.01366	60.766	-0.01010	0.01010
-	60.810	-0.01404	0.01404	60.810	-0.01017	0.01017
-	60.853	-0.01478	0.01478	60.853	-0.01054	0.01054
-	60.897	-0.01500	0.01500	60.897	-0.01078	0.01078
-	60.940	-0.01528	0.01528	60.940	-0.01102	0.01102
-	60.984	-0.01532	0.01532	60.984	-0.01130	0.01130
-	61.028	-0.01552	0.01552	61.028	-0.01158	0.01158
-	61.071	-0.01571	0.01571	61.071	-0.01202	0.01202
-	61.115	-0.01561	0.01561	61.115	-0.01178	0.01178
71	61.115	-0.01561	0.01561	61.115	-0.01178	0.01178
-	61.159	-0.01546	0.01546	61.159	-0.01137	0.01137
-	61.202	-0.01523	0.01523	61.202	-0.01108	0.01108
-	61.246	-0.01513	0.01513	61.246	-0.01066	0.01066
-	61.289	-0.01476	0.01476	61.289	-0.01097	0.01097
-	61.333	-0.01523	0.01523	61.333	-0.01151	0.01151

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-	61.377	-0.01580	0.01580	61.377	-0.01154	0.01154
-	61.420	-0.01541	0.01541	61.420	-0.01132	0.01132
-	61.464	-0.01479	0.01479	61.464	-0.01129	0.01129
-	61.507	-0.01487	0.01487	61.507	-0.01105	0.01105
-	61.551	-0.01478	0.01478	61.551	-0.01108	0.01108
-	61.595	-0.01456	0.01456	61.595	-0.01074	0.01074
-	61.638	-0.01423	0.01423	61.638	-0.01056	0.01056
-	61.682	-0.01416	0.01416	61.682	-0.01033	0.01033
-	61.726	-0.01440	0.01440	61.726	-0.01029	0.01029
-	61.769	-0.01436	0.01436	61.769	-0.01063	0.01063
-	61.813	-0.01466	0.01466	61.813	-0.01075	0.01075
-	61.856	-0.01460	0.01460	61.856	-0.01074	0.01074
-	61.900	-0.01463	0.01463	61.900	-0.01060	0.01060
-	61.944	-0.01461	0.01461	61.944	-0.01083	0.01083
-	61.987	-0.01493	0.01493	61.987	-0.01081	0.01081
72	61.987	-0.01493	0.01493	61.987	-0.01081	0.01081
-	62.031	-0.01512	0.01512	62.031	-0.01124	0.01124
-	62.074	-0.01515	0.01515	62.074	-0.01107	0.01107
-	62.118	-0.01510	0.01510	62.118	-0.01071	0.01071
-	62.162	-0.01447	0.01447	62.162	-0.01046	0.01046
-	62.205	-0.01436	0.01436	62.205	-0.01016	0.01016
-	62.249	-0.01392	0.01392	62.249	-0.00987	0.00987
-	62.293	-0.01359	0.01359	62.293	-0.00982	0.00982
-	62.336	-0.01348	0.01348	62.336	-0.01018	0.01018
-	62.380	-0.01361	0.01361	62.380	-0.01011	0.01011
-	62.423	-0.01386	0.01386	62.423	-0.00992	0.00992
-	62.467	-0.01357	0.01357	62.467	-0.00991	0.00991
-	62.511	-0.01370	0.01370	62.511	-0.00997	0.00997
-	62.554	-0.01429	0.01429	62.554	-0.01029	0.01029
-	62.598	-0.01478	0.01478	62.598	-0.01071	0.01071
-	62.642	-0.01509	0.01509	62.642	-0.01126	0.01126
-	62.685	-0.01532	0.01532	62.685	-0.01130	0.01130
-	62.729	-0.01543	0.01543	62.729	-0.01121	0.01121
-	62.772	-0.01544	0.01544	62.772	-0.01134	0.01134
-	62.816	-0.01538	0.01538	62.816	-0.01129	0.01129
-	62.860	-0.01532	0.01532	62.860	-0.01128	0.01128
73	62.860	-0.01532	0.01532	62.860	-0.01128	0.01128
-	62.903	-0.01504	0.01504	62.903	-0.01107	0.01107
-	62.947	-0.01493	0.01493	62.947	-0.01112	0.01112
-	62.990	-0.01486	0.01486	62.990	-0.01081	0.01081
-	63.034	-0.01475	0.01475	63.034	-0.01075	0.01075
-	63.078	-0.01544	0.01544	63.078	-0.01156	0.01156
-	63.121	-0.01567	0.01567	63.121	-0.01176	0.01176
-	63.165	-0.01521	0.01521	63.165	-0.01123	0.01123
-	63.209	-0.01443	0.01443	63.209	-0.01090	0.01090
-	63.252	-0.01385	0.01385	63.252	-0.01034	0.01034
-	63.296	-0.01364	0.01364	63.296	-0.00993	0.00993
-	63.339	-0.01326	0.01326	63.339	-0.00989	0.00989

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-	63.383	-0.01302	0.01302	63.383	-0.00987	0.00987
-	63.427	-0.01299	0.01299	63.427	-0.00968	0.00968
-	63.470	-0.01307	0.01307	63.470	-0.00965	0.00965
-	63.514	-0.01313	0.01313	63.514	-0.00982	0.00982
-	63.557	-0.01354	0.01354	63.557	-0.01019	0.01019
-	63.601	-0.01415	0.01415	63.601	-0.01056	0.01056
-	63.645	-0.01466	0.01466	63.645	-0.01085	0.01085
-	63.688	-0.01485	0.01485	63.688	-0.01124	0.01124
-	63.732	-0.01512	0.01512	63.732	-0.01145	0.01145
74	63.732	-0.01512	0.01512	63.732	-0.01145	0.01145
-	63.776	-0.01552	0.01552	63.776	-0.01184	0.01184
-	63.819	-0.01565	0.01565	63.819	-0.01196	0.01196
-	63.863	-0.01528	0.01528	63.863	-0.01150	0.01150
-	63.906	-0.01486	0.01486	63.906	-0.01126	0.01126
-	63.950	-0.01461	0.01461	63.950	-0.01106	0.01106
-	63.994	-0.01454	0.01454	63.994	-0.01097	0.01097
-	64.037	-0.01449	0.01449	64.037	-0.01107	0.01107
-	64.081	-0.01424	0.01424	64.081	-0.01094	0.01094
-	64.125	-0.01424	0.01424	64.125	-0.01076	0.01076
-	64.168	-0.01422	0.01422	64.168	-0.01075	0.01075
-	64.212	-0.01446	0.01446	64.212	-0.01081	0.01081
-	64.255	-0.01466	0.01466	64.255	-0.01101	0.01101
-	64.299	-0.01478	0.01478	64.299	-0.01132	0.01132
-	64.343	-0.01512	0.01512	64.343	-0.01161	0.01161
-	64.386	-0.01543	0.01543	64.386	-0.01176	0.01176
-	64.430	-0.01565	0.01565	64.430	-0.01190	0.01190
-	64.473	-0.01550	0.01550	64.473	-0.01183	0.01183
-	64.517	-0.01541	0.01541	64.517	-0.01167	0.01167
-	64.561	-0.01540	0.01540	64.561	-0.01161	0.01161
-	64.604	-0.01519	0.01519	64.604	-0.01162	0.01162
75	64.604	-0.01519	0.01519	64.604	-0.01162	0.01162
-	64.648	-0.01507	0.01507	64.648	-0.01151	0.01151
-	64.692	-0.01487	0.01487	64.692	-0.01140	0.01140
-	64.735	-0.01484	0.01484	64.735	-0.01129	0.01129
-	64.779	-0.01473	0.01473	64.779	-0.01122	0.01122
-	64.822	-0.01480	0.01480	64.822	-0.01113	0.01113
-	64.866	-0.01479	0.01479	64.866	-0.01111	0.01111
-	64.910	-0.01481	0.01481	64.910	-0.01126	0.01126
-	64.953	-0.01502	0.01502	64.953	-0.01146	0.01146
-	64.997	-0.01525	0.01525	64.997	-0.01162	0.01162
-	65.041	-0.01536	0.01536	65.041	-0.01173	0.01173
-	65.084	-0.01534	0.01534	65.084	-0.01172	0.01172
-	65.128	-0.01540	0.01540	65.128	-0.01167	0.01167
-	65.171	-0.01554	0.01554	65.171	-0.01176	0.01176
-	65.215	-0.01564	0.01564	65.215	-0.01187	0.01187
-	65.259	-0.01565	0.01565	65.259	-0.01190	0.01190
-	65.302	-0.01553	0.01553	65.302	-0.01181	0.01181
-	65.346	-0.01540	0.01540	65.346	-0.01174	0.01174

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-	65.389	-0.01534	0.01534	65.389	-0.01171	0.01171
-	65.433	-0.01530	0.01530	65.433	-0.01164	0.01164
-	65.477	-0.01522	0.01522	65.477	-0.01164	0.01164
76	65.477	-0.01522	0.01522	65.477	-0.01164	0.01164
-	65.520	-0.01509	0.01509	65.520	-0.01159	0.01159
-	65.564	-0.01509	0.01509	65.564	-0.01136	0.01136
-	65.608	-0.01505	0.01505	65.608	-0.01139	0.01139
-	65.651	-0.01505	0.01505	65.651	-0.01143	0.01143
-	65.695	-0.01508	0.01508	65.695	-0.01133	0.01133
-	65.738	-0.01503	0.01503	65.738	-0.01138	0.01138
-	65.782	-0.01490	0.01490	65.782	-0.01123	0.01123
-	65.826	-0.01486	0.01486	65.826	-0.01114	0.01114
-	65.869	-0.01477	0.01477	65.869	-0.01116	0.01116
-	65.913	-0.01484	0.01484	65.913	-0.01136	0.01136
-	65.956	-0.01490	0.01490	65.956	-0.01149	0.01149
-	66.000	-0.01509	0.01509	66.000	-0.01144	0.01144
-	66.044	-0.01504	0.01504	66.044	-0.01147	0.01147
-	66.087	-0.01512	0.01512	66.087	-0.01145	0.01145
-	66.131	-0.01529	0.01529	66.131	-0.01159	0.01159
-	66.175	-0.01556	0.01556	66.175	-0.01175	0.01175
-	66.218	-0.01563	0.01563	66.218	-0.01192	0.01192
-	66.262	-0.01554	0.01554	66.262	-0.01188	0.01188
-	66.305	-0.01549	0.01549	66.305	-0.01181	0.01181
-	66.349	-0.01555	0.01555	66.349	-0.01180	0.01180
77	66.349	-0.01555	0.01555	66.349	-0.01180	0.01180
-	66.393	-0.01542	0.01542	66.393	-0.01169	0.01169
-	66.436	-0.01519	0.01519	66.436	-0.01153	0.01153
-	66.480	-0.01497	0.01497	66.480	-0.01131	0.01131
-	66.524	-0.01485	0.01485	66.524	-0.01129	0.01129
-	66.567	-0.01543	0.01543	66.567	-0.01170	0.01170
-	66.611	-0.01558	0.01558	66.611	-0.01179	0.01179
-	66.654	-0.01486	0.01486	66.654	-0.01123	0.01123
-	66.698	-0.01406	0.01406	66.698	-0.01045	0.01045
-	66.742	-0.01349	0.01349	66.742	-0.00987	0.00987
-	66.785	-0.01325	0.01325	66.785	-0.00961	0.00961
-	66.829	-0.01311	0.01311	66.829	-0.00972	0.00972
-	66.872	-0.01286	0.01286	66.872	-0.00964	0.00964
-	66.916	-0.01291	0.01291	66.916	-0.00986	0.00986
-	66.960	-0.01321	0.01321	66.960	-0.01018	0.01018
-	67.003	-0.01381	0.01381	67.003	-0.01024	0.01024
-	67.047	-0.01419	0.01419	67.047	-0.01062	0.01062
-	67.091	-0.01445	0.01445	67.091	-0.01086	0.01086
-	67.134	-0.01519	0.01519	67.134	-0.01134	0.01134
-	67.178	-0.01551	0.01551	67.178	-0.01171	0.01171
-	67.221	-0.01543	0.01543	67.221	-0.01160	0.01160
78	67.221	-0.01543	0.01543	67.221	-0.01160	0.01160
-	67.265	-0.01499	0.01499	67.265	-0.01145	0.01145
-	67.309	-0.01609	0.01609	67.309	-0.01157	0.01157

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-	67.352	-0.01571	0.01571	67.352	-0.01134	0.01134
-	67.396	-0.01502	0.01502	67.396	-0.01087	0.01087
-	67.439	-0.01437	0.01437	67.439	-0.01023	0.01023
-	67.483	-0.01363	0.01363	67.483	-0.00971	0.00971
-	67.527	-0.01341	0.01341	67.527	-0.00930	0.00930
-	67.570	-0.01298	0.01298	67.570	-0.00919	0.00919
-	67.614	-0.01300	0.01300	67.614	-0.00900	0.00900
-	67.658	-0.01268	0.01268	67.658	-0.00871	0.00871
-	67.701	-0.01281	0.01281	67.701	-0.00876	0.00876
-	67.745	-0.01311	0.01311	67.745	-0.00895	0.00895
-	67.788	-0.01338	0.01338	67.788	-0.00910	0.00910
-	67.832	-0.01368	0.01368	67.832	-0.00950	0.00950
-	67.876	-0.01408	0.01408	67.876	-0.01003	0.01003
-	67.919	-0.01477	0.01477	67.919	-0.01063	0.01063
-	67.963	-0.01536	0.01536	67.963	-0.01094	0.01094
-	68.006	-0.01564	0.01564	68.006	-0.01135	0.01135
-	68.050	-0.01578	0.01578	68.050	-0.01145	0.01145
-	68.094	-0.01573	0.01573	68.094	-0.01129	0.01129
79	68.094	-0.01573	0.01573	68.094	-0.01129	0.01129
-	68.137	-0.01546	0.01546	68.137	-0.01114	0.01114
-	68.181	-0.01511	0.01511	68.181	-0.01073	0.01073
-	68.225	-0.01460	0.01460	68.225	-0.01041	0.01041
-	68.268	-0.01421	0.01421	68.268	-0.01006	0.01006
-	68.312	-0.01592	0.01592	68.312	-0.01216	0.01216
-	68.355	-0.01504	0.01504	68.355	-0.01089	0.01089
-	68.399	-0.01436	0.01436	68.399	-0.01022	0.01022
-	68.443	-0.01338	0.01338	68.443	-0.00927	0.00927
-	68.486	-0.01395	0.01395	68.486	-0.00868	0.00868
-	68.530	-0.01459	0.01459	68.530	-0.00948	0.00948
-	68.574	-0.01477	0.01477	68.574	-0.00944	0.00944
-	68.617	-0.01464	0.01464	68.617	-0.00988	0.00988
-	68.661	-0.01439	0.01439	68.661	-0.00958	0.00958
-	68.704	-0.01374	0.01374	68.704	-0.00902	0.00902
-	68.748	-0.01321	0.01321	68.748	-0.00871	0.00871
-	68.792	-0.01276	0.01276	68.792	-0.00798	0.00798
-	68.835	-0.01241	0.01241	68.835	-0.00759	0.00759
-	68.879	-0.01246	0.01246	68.879	-0.00735	0.00735
-	68.922	-0.01246	0.01246	68.922	-0.00744	0.00744
-	68.966	-0.01300	0.01300	68.966	-0.00811	0.00811
80	68.966	-0.01300	0.01300	68.966	-0.00811	0.00811
-	69.010	-0.01357	0.01357	69.010	-0.00869	0.00869
-	69.053	-0.01576	0.01576	69.053	-0.01131	0.01131
-	69.097	-0.01517	0.01517	69.097	-0.01098	0.01098
-	69.141	-0.01481	0.01481	69.141	-0.01071	0.01071
-	69.184	-0.01456	0.01456	69.184	-0.00986	0.00986
-	69.228	-0.01425	0.01425	69.228	-0.00931	0.00931
-	69.271	-0.01345	0.01345	69.271	-0.00913	0.00913
-	69.315	-0.01293	0.01293	69.315	-0.00921	0.00921

ANALYSIS OF DIFFERENTIAL SETTLEMENT OF BALLASTED RAILWAY TRACK

-	69.359	-0.01308	0.01308	69.359	-0.00958	0.00958
-	69.402	-0.01363	0.01363	69.402	-0.00968	0.00968
-	69.446	-0.01368	0.01368	69.446	-0.00981	0.00981
-	69.490	-0.01343	0.01343	69.490	-0.00959	0.00959
-	69.533	-0.01387	0.01387	69.533	-0.00962	0.00962
-	69.577	-0.01457	0.01457	69.577	-0.00986	0.00986
-	69.620	-0.01497	0.01497	69.620	-0.01030	0.01030
-	69.664	-0.01498	0.01498	69.664	-0.01091	0.01091
-	69.708	-0.01508	0.01508	69.708	-0.01090	0.01090
-	69.751	-0.01515	0.01515	69.751	-0.01091	0.01091
-	69.795	-0.01505	0.01505	69.795	-0.01090	0.01090
-	69.838	-0.01492	0.01492	69.838	-0.01064	0.01064
81	69.838	-0.01492	0.01492	69.838	-0.01064	0.01064
-	69.882	-0.01471	0.01471	69.882	-0.01059	0.01059
-	69.926	-0.01480	0.01480	69.926	-0.01042	0.01042
-	69.969	-0.01461	0.01461	69.969	-0.01037	0.01037
-	70.013	-0.01496	0.01496	70.013	-0.01027	0.01027
-	70.057	-0.01505	0.01505	70.057	-0.01020	0.01020
-	70.100	-0.01492	0.01492	70.100	-0.01050	0.01050
-	70.144	-0.01489	0.01489	70.144	-0.01074	0.01074
-	70.187	-0.01458	0.01458	70.187	-0.01048	0.01048
-	70.231	-0.01433	0.01433	70.231	-0.01016	0.01016
-	70.275	-0.01366	0.01366	70.275	-0.00926	0.00926
-	70.318	-0.01299	0.01299	70.318	-0.00855	0.00855
-	70.362	-0.01295	0.01295	70.362	-0.00844	0.00844
-	70.405	-0.01291	0.01291	70.405	-0.00869	0.00869
-	70.449	-0.01327	0.01327	70.449	-0.00919	0.00919
-	70.493	-0.01309	0.01309	70.493	-0.00918	0.00918
-	70.536	-0.01311	0.01311	70.536	-0.00897	0.00897
-	70.580	-0.01326	0.01326	70.580	-0.00904	0.00904
-	70.624	-0.01366	0.01366	70.624	-0.00925	0.00925
-	70.667	-0.01420	0.01420	70.667	-0.00982	0.00982
-	70.711	-0.01471	0.01471	70.711	-0.01049	0.01049
82	70.711	-0.01471	0.01471	70.711	-0.01049	0.01049
-	70.754	-0.01543	0.01543	70.754	-0.01109	0.01109
-	70.798	-0.01579	0.01579	70.798	-0.01160	0.01160
-	70.842	-0.01561	0.01561	70.842	-0.01138	0.01138
-	70.885	-0.01535	0.01535	70.885	-0.01106	0.01106
-	70.929	-0.01518	0.01518	70.929	-0.01056	0.01056
-	70.973	-0.01462	0.01462	70.973	-0.01019	0.01019
-	71.016	-0.01401	0.01401	71.016	-0.01000	0.01000
-	71.060	-0.01388	0.01388	71.060	-0.00979	0.00979
-	71.103	-0.01411	0.01411	71.103	-0.00975	0.00975
-	71.147	-0.01393	0.01393	71.147	-0.00973	0.00973
-	71.191	-0.01385	0.01385	71.191	-0.00982	0.00982
-	71.234	-0.01417	0.01417	71.234	-0.01001	0.01001
-	71.278	-0.01476	0.01476	71.278	-0.01025	0.01025
-	71.321	-0.01489	0.01489	71.321	-0.01037	0.01037

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-	71.365	-0.01487	0.01487	71.365	-0.01061	0.01061
-	71.409	-0.01520	0.01520	71.409	-0.01070	0.01070
-	71.452	-0.01552	0.01552	71.452	-0.01104	0.01104
-	71.496	-0.01553	0.01553	71.496	-0.01115	0.01115
-	71.540	-0.01537	0.01537	71.540	-0.01113	0.01113
-	71.583	-0.01555	0.01555	71.583	-0.01105	0.01105
83	71.583	-0.01555	0.01555	71.583	-0.01105	0.01105
-	71.627	-0.01540	0.01540	71.627	-0.01081	0.01081
-	71.670	-0.01524	0.01524	71.670	-0.01079	0.01079
-	71.714	-0.01508	0.01508	71.714	-0.01062	0.01062
-	71.758	-0.01520	0.01520	71.758	-0.01069	0.01069
-	71.801	-0.01564	0.01564	71.801	-0.01206	0.01206
-	71.845	-0.01523	0.01523	71.845	-0.01156	0.01156
-	71.888	-0.01490	0.01490	71.888	-0.01054	0.01054
-	71.932	-0.01382	0.01382	71.932	-0.01004	0.01004
-	71.976	-0.01352	0.01352	71.976	-0.00989	0.00989
-	72.019	-0.01358	0.01358	72.019	-0.01003	0.01003
-	72.063	-0.01377	0.01377	72.063	-0.01035	0.01035
-	72.107	-0.01375	0.01375	72.107	-0.01081	0.01081
-	72.150	-0.01360	0.01360	72.150	-0.01046	0.01046
-	72.194	-0.01389	0.01389	72.194	-0.01029	0.01029
-	72.237	-0.01415	0.01415	72.237	-0.01056	0.01056
-	72.281	-0.01464	0.01464	72.281	-0.01055	0.01055
-	72.325	-0.01482	0.01482	72.325	-0.01105	0.01105
-	72.368	-0.01489	0.01489	72.368	-0.01116	0.01116
-	72.412	-0.01515	0.01515	72.412	-0.01161	0.01161
-	72.456	-0.01552	0.01552	72.456	-0.01153	0.01153
84	72.456	-0.01552	0.01552	72.456	-0.01153	0.01153
-	72.499	-0.01514	0.01514	72.499	-0.01101	0.01101
-	72.543	-0.01456	0.01456	72.543	-0.01087	0.01087
-	72.586	-0.01467	0.01467	72.586	-0.01064	0.01064
-	72.630	-0.01436	0.01436	72.630	-0.01052	0.01052
-	72.674	-0.01439	0.01439	72.674	-0.01087	0.01087
-	72.717	-0.01426	0.01426	72.717	-0.01095	0.01095
-	72.761	-0.01453	0.01453	72.761	-0.01116	0.01116
-	72.804	-0.01478	0.01478	72.804	-0.01123	0.01123
-	72.848	-0.01449	0.01449	72.848	-0.01100	0.01100
-	72.892	-0.01483	0.01483	72.892	-0.01108	0.01108
-	72.935	-0.01496	0.01496	72.935	-0.01116	0.01116
-	72.979	-0.01535	0.01535	72.979	-0.01124	0.01124
-	73.023	-0.01506	0.01506	73.023	-0.01141	0.01141
-	73.066	-0.01494	0.01494	73.066	-0.01128	0.01128
-	73.110	-0.01504	0.01504	73.110	-0.01140	0.01140
-	73.153	-0.01502	0.01502	73.153	-0.01143	0.01143
-	73.197	-0.01493	0.01493	73.197	-0.01123	0.01123
-	73.241	-0.01457	0.01457	73.241	-0.01113	0.01113
-	73.284	-0.01470	0.01470	73.284	-0.01086	0.01086
-	73.328	-0.01470	0.01470	73.328	-0.01095	0.01095

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85	73.328	-0.01470	0.01470	73.328	-0.01095	0.01095
-	73.371	-0.01479	0.01479	73.371	-0.01091	0.01091
-	73.415	-0.01469	0.01469	73.415	-0.01100	0.01100
-	73.459	-0.01471	0.01471	73.459	-0.01095	0.01095
-	73.502	-0.01465	0.01465	73.502	-0.01087	0.01087
-	73.546	-0.01492	0.01492	73.546	-0.01087	0.01087
-	73.590	-0.01453	0.01453	73.590	-0.01068	0.01068
-	73.633	-0.01390	0.01390	73.633	-0.01046	0.01046
-	73.677	-0.01336	0.01336	73.677	-0.01003	0.01003
-	73.720	-0.01300	0.01300	73.720	-0.00951	0.00951
-	73.764	-0.01303	0.01303	73.764	-0.00903	0.00903
-	73.808	-0.01261	0.01261	73.808	-0.00872	0.00872
-	73.851	-0.01274	0.01274	73.851	-0.00883	0.00883
-	73.895	-0.01322	0.01322	73.895	-0.00942	0.00942
-	73.939	-0.01357	0.01357	73.939	-0.00989	0.00989
-	73.982	-0.01403	0.01403	73.982	-0.01045	0.01045
-	74.026	-0.01437	0.01437	74.026	-0.01075	0.01075
-	74.069	-0.01464	0.01464	74.069	-0.01056	0.01056
-	74.113	-0.01445	0.01445	74.113	-0.01064	0.01064
-	74.157	-0.01410	0.01410	74.157	-0.01038	0.01038
-	74.200	-0.01404	0.01404	74.200	-0.01020	0.01020
86	74.200	-0.01404	0.01404	74.200	-0.01020	0.01020
-	74.244	-0.01340	0.01340	74.244	-0.00997	0.00997
-	74.287	-0.01330	0.01330	74.287	-0.00943	0.00943
-	74.331	-0.01303	0.01303	74.331	-0.00904	0.00904
-	74.375	-0.01303	0.01303	74.375	-0.00866	0.00866
-	74.418	-0.01247	0.01247	74.418	-0.00831	0.00831
-	74.462	-0.01208	0.01208	74.462	-0.00780	0.00780
-	74.506	-0.01190	0.01190	74.506	-0.00797	0.00797
-	74.549	-0.01201	0.01201	74.549	-0.00815	0.00815
-	74.593	-0.01197	0.01197	74.593	-0.00833	0.00833
-	74.636	-0.01182	0.01182	74.636	-0.00818	0.00818
-	74.680	-0.01184	0.01184	74.680	-0.00812	0.00812
-	74.724	-0.01214	0.01214	74.724	-0.00830	0.00830
-	74.767	-0.01285	0.01285	74.767	-0.00871	0.00871
-	74.811	-0.01348	0.01348	74.811	-0.00954	0.00954
-	74.854	-0.01423	0.01423	74.854	-0.01039	0.01039
-	74.898	-0.01478	0.01478	74.898	-0.01097	0.01097
-	74.942	-0.01503	0.01503	74.942	-0.01110	0.01110
-	74.985	-0.01460	0.01460	74.985	-0.01052	0.01052
-	75.029	-0.01395	0.01395	75.029	-0.00999	0.00999
-	75.073	-0.01349	0.01349	75.073	-0.00951	0.00951
87	75.073	-0.01349	0.01349	75.073	-0.00951	0.00951
-	75.116	-0.01300	0.01300	75.116	-0.00893	0.00893
-	75.160	-0.01306	0.01306	75.160	-0.00909	0.00909
-	75.203	-0.01286	0.01286	75.203	-0.00903	0.00903
-	75.247	-0.01265	0.01265	75.247	-0.00916	0.00916
-	75.291	-0.01482	0.01482	75.291	-0.01056	0.01056

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-	75.334	-0.01520	0.01520	75.334	-0.01125	0.01125
-	75.378	-0.01469	0.01469	75.378	-0.01102	0.01102
-	75.422	-0.01416	0.01416	75.422	-0.01016	0.01016
-	75.465	-0.01304	0.01304	75.465	-0.00896	0.00896
-	75.509	-0.01201	0.01201	75.509	-0.00788	0.00788
-	75.552	-0.01134	0.01134	75.552	-0.00749	0.00749
-	75.596	-0.01144	0.01144	75.596	-0.00727	0.00727
-	75.640	-0.01169	0.01169	75.640	-0.00782	0.00782
-	75.683	-0.01169	0.01169	75.683	-0.00836	0.00836
-	75.727	-0.01223	0.01223	75.727	-0.00864	0.00864
-	75.770	-0.01266	0.01266	75.770	-0.00872	0.00872
-	75.814	-0.01321	0.01321	75.814	-0.00892	0.00892
-	75.858	-0.01330	0.01330	75.858	-0.00929	0.00929
-	75.901	-0.01386	0.01386	75.901	-0.00946	0.00946
-	75.945	-0.01404	0.01404	75.945	-0.00966	0.00966
88	75.945	-0.01404	0.01404	75.945	-0.00966	0.00966
-	75.989	-0.01391	0.01391	75.989	-0.01010	0.01010
-	76.032	-0.01456	0.01456	76.032	-0.01065	0.01065
-	76.076	-0.01519	0.01519	76.076	-0.01119	0.01119
-	76.119	-0.01491	0.01491	76.119	-0.01103	0.01103
-	76.163	-0.01424	0.01424	76.163	-0.01079	0.01079
-	76.207	-0.01428	0.01428	76.207	-0.01013	0.01013
-	76.250	-0.01421	0.01421	76.250	-0.00966	0.00966
-	76.294	-0.01344	0.01344	76.294	-0.00922	0.00922
-	76.337	-0.01321	0.01321	76.337	-0.00899	0.00899
-	76.381	-0.01306	0.01306	76.381	-0.00911	0.00911
-	76.425	-0.01350	0.01350	76.425	-0.00925	0.00925
-	76.468	-0.01328	0.01328	76.468	-0.00982	0.00982
-	76.512	-0.01361	0.01361	76.512	-0.00957	0.00957
-	76.556	-0.01360	0.01360	76.556	-0.00936	0.00936
-	76.599	-0.01362	0.01362	76.599	-0.00935	0.00935
-	76.643	-0.01386	0.01386	76.643	-0.00959	0.00959
-	76.686	-0.01414	0.01414	76.686	-0.00998	0.00998
-	76.730	-0.01465	0.01465	76.730	-0.01048	0.01048
-	76.774	-0.01444	0.01444	76.774	-0.01055	0.01055
-	76.817	-0.01438	0.01438	76.817	-0.01015	0.01015
89	76.817	-0.01438	0.01438	76.817	-0.01015	0.01015
-	76.861	-0.01409	0.01409	76.861	-0.00973	0.00973
-	76.905	-0.01387	0.01387	76.905	-0.00952	0.00952
-	76.948	-0.01355	0.01355	76.948	-0.00943	0.00943
-	76.992	-0.01377	0.01377	76.992	-0.00953	0.00953
-	77.035	-0.01406	0.01406	77.035	-0.01070	0.01070
-	77.079	-0.01515	0.01515	77.079	-0.01154	0.01154
-	77.123	-0.01499	0.01499	77.123	-0.01168	0.01168
-	77.166	-0.01445	0.01445	77.166	-0.01115	0.01115
-	77.210	-0.01348	0.01348	77.210	-0.01007	0.01007
-	77.253	-0.01283	0.01283	77.253	-0.00941	0.00941
-	77.297	-0.01271	0.01271	77.297	-0.00906	0.00906

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-	77.341	-0.01265	0.01265	77.341	-0.00894	0.00894
-	77.384	-0.01267	0.01267	77.384	-0.00956	0.00956
-	77.428	-0.01284	0.01284	77.428	-0.00998	0.00998
-	77.472	-0.01339	0.01339	77.472	-0.01035	0.01035
-	77.515	-0.01390	0.01390	77.515	-0.01047	0.01047
-	77.559	-0.01400	0.01400	77.559	-0.01052	0.01052
-	77.602	-0.01432	0.01432	77.602	-0.01060	0.01060
-	77.646	-0.01446	0.01446	77.646	-0.01081	0.01081
-	77.690	-0.01455	0.01455	77.690	-0.01103	0.01103
90	77.690	-0.01455	0.01455	77.690	-0.01103	0.01103
-	77.733	-0.01435	0.01435	77.733	-0.01119	0.01119
-	77.777	-0.01411	0.01411	77.777	-0.01097	0.01097
-	77.820	-0.01399	0.01399	77.820	-0.01058	0.01058
-	77.864	-0.01403	0.01403	77.864	-0.01040	0.01040
-	77.908	-0.01402	0.01402	77.908	-0.01026	0.01026
-	77.951	-0.01396	0.01396	77.951	-0.01043	0.01043
-	77.995	-0.01421	0.01421	77.995	-0.01076	0.01076
-	78.039	-0.01444	0.01444	78.039	-0.01114	0.01114
-	78.082	-0.01470	0.01470	78.082	-0.01112	0.01112
-	78.126	-0.01442	0.01442	78.126	-0.01098	0.01098
-	78.169	-0.01427	0.01427	78.169	-0.01074	0.01074
-	78.213	-0.01429	0.01429	78.213	-0.01075	0.01075
-	78.257	-0.01435	0.01435	78.257	-0.01074	0.01074
-	78.300	-0.01431	0.01431	78.300	-0.01091	0.01091
-	78.344	-0.01412	0.01412	78.344	-0.01091	0.01091
-	78.388	-0.01412	0.01412	78.388	-0.01059	0.01059
-	78.431	-0.01417	0.01417	78.431	-0.01062	0.01062
-	78.475	-0.01416	0.01416	78.475	-0.01054	0.01054
-	78.518	-0.01430	0.01430	78.518	-0.01068	0.01068
-	78.562	-0.01446	0.01446	78.562	-0.01106	0.01106
91	78.562	-0.01446	0.01446	78.562	-0.01106	0.01106
-	78.606	-0.01472	0.01472	78.606	-0.01117	0.01117
-	78.649	-0.01484	0.01484	78.649	-0.01155	0.01155
-	78.693	-0.01495	0.01495	78.693	-0.01150	0.01150
-	78.736	-0.01473	0.01473	78.736	-0.01130	0.01130
-	78.780	-0.01455	0.01455	78.780	-0.01201	0.01201
-	78.824	-0.01487	0.01487	78.824	-0.01192	0.01192
-	78.867	-0.01440	0.01440	78.867	-0.01131	0.01131
-	78.911	-0.01381	0.01381	78.911	-0.01075	0.01075
-	78.955	-0.01342	0.01342	78.955	-0.01028	0.01028
-	78.998	-0.01337	0.01337	78.998	-0.01060	0.01060
-	79.042	-0.01377	0.01377	79.042	-0.01098	0.01098
-	79.085	-0.01352	0.01352	79.085	-0.01090	0.01090
-	79.129	-0.01324	0.01324	79.129	-0.01071	0.01071
-	79.173	-0.01301	0.01301	79.173	-0.01020	0.01020
-	79.216	-0.01326	0.01326	79.216	-0.01029	0.01029
-	79.260	-0.01380	0.01380	79.260	-0.01077	0.01077
-	79.304	-0.01412	0.01412	79.304	-0.01130	0.01130

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-	79.347	-0.01446	0.01446	79.347	-0.01180	0.01180
-	79.391	-0.01460	0.01460	79.391	-0.01186	0.01186
-	79.434	-0.01492	0.01492	79.434	-0.01168	0.01168
92	79.434	-0.01492	0.01492	79.434	-0.01168	0.01168
-	79.478	-0.01434	0.01434	79.478	-0.01134	0.01134
-	79.522	-0.01515	0.01515	79.522	-0.01188	0.01188
-	79.565	-0.01508	0.01508	79.565	-0.01195	0.01195
-	79.609	-0.01465	0.01465	79.609	-0.01187	0.01187
-	79.652	-0.01400	0.01400	79.652	-0.01174	0.01174
-	79.696	-0.01414	0.01414	79.696	-0.01136	0.01136
-	79.740	-0.01412	0.01412	79.740	-0.01152	0.01152
-	79.783	-0.01372	0.01372	79.783	-0.01091	0.01091
-	79.827	-0.01345	0.01345	79.827	-0.01099	0.01099
-	79.871	-0.01356	0.01356	79.871	-0.01088	0.01088
-	79.914	-0.01392	0.01392	79.914	-0.01099	0.01099
-	79.958	-0.01403	0.01403	79.958	-0.01154	0.01154
-	80.001	-0.01400	0.01400	80.001	-0.01129	0.01129
-	80.045	-0.01434	0.01434	80.045	-0.01178	0.01178
-	80.089	-0.01478	0.01478	80.089	-0.01187	0.01187
-	80.132	-0.01500	0.01500	80.132	-0.01190	0.01190
-	80.176	-0.01490	0.01490	80.176	-0.01205	0.01205
-	80.219	-0.01489	0.01489	80.219	-0.01162	0.01162
-	80.263	-0.01494	0.01494	80.263	-0.01191	0.01191
-	80.307	-0.01486	0.01486	80.307	-0.01183	0.01183
93	80.307	-0.01486	0.01486	80.307	-0.01183	0.01183
-	80.350	-0.01439	0.01439	80.350	-0.01176	0.01176
-	80.394	-0.01460	0.01460	80.394	-0.01185	0.01185
-	80.438	-0.01412	0.01412	80.438	-0.01121	0.01121
-	80.481	-0.01407	0.01407	80.481	-0.01106	0.01106
-	80.525	-0.01540	0.01540	80.525	-0.01147	0.01147
-	80.568	-0.01470	0.01470	80.568	-0.01152	0.01152
-	80.612	-0.01414	0.01414	80.612	-0.01142	0.01142
-	80.656	-0.01381	0.01381	80.656	-0.01104	0.01104
-	80.699	-0.01364	0.01364	80.699	-0.01051	0.01051
-	80.743	-0.01335	0.01335	80.743	-0.00997	0.00997
-	80.787	-0.01279	0.01279	80.787	-0.00956	0.00956
-	80.830	-0.01291	0.01291	80.830	-0.00956	0.00956
-	80.874	-0.01336	0.01336	80.874	-0.00998	0.00998
-	80.917	-0.01373	0.01373	80.917	-0.01053	0.01053
-	80.961	-0.01391	0.01391	80.961	-0.01110	0.01110
-	81.005	-0.01406	0.01406	81.005	-0.01120	0.01120
-	81.048	-0.01467	0.01467	81.048	-0.01101	0.01101
-	81.092	-0.01451	0.01451	81.092	-0.01105	0.01105
-	81.135	-0.01396	0.01396	81.135	-0.01088	0.01088
-	81.179	-0.01387	0.01387	81.179	-0.01087	0.01087
94	81.179	-0.01387	0.01387	81.179	-0.01087	0.01087
-	81.223	-0.01380	0.01380	81.223	-0.01164	0.01164
-	81.266	-0.01398	0.01398	81.266	-0.01094	0.01094

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-	81.310	-0.01348	0.01348	81.310	-0.01021	0.01021
-	81.354	-0.01293	0.01293	81.354	-0.00967	0.00967
-	81.397	-0.01244	0.01244	81.397	-0.00932	0.00932
-	81.441	-0.01253	0.01253	81.441	-0.00963	0.00963
-	81.484	-0.01247	0.01247	81.484	-0.00964	0.00964
-	81.528	-0.01228	0.01228	81.528	-0.00962	0.00962
-	81.572	-0.01195	0.01195	81.572	-0.00944	0.00944
-	81.615	-0.01195	0.01195	81.615	-0.00925	0.00925
-	81.659	-0.01210	0.01210	81.659	-0.00933	0.00933
-	81.702	-0.01240	0.01240	81.702	-0.00955	0.00955
-	81.746	-0.01281	0.01281	81.746	-0.01016	0.01016
-	81.790	-0.01331	0.01331	81.790	-0.01068	0.01068
-	81.833	-0.01402	0.01402	81.833	-0.01123	0.01123
-	81.877	-0.01457	0.01457	81.877	-0.01170	0.01170
-	81.921	-0.01498	0.01498	81.921	-0.01195	0.01195
-	81.964	-0.01488	0.01488	81.964	-0.01207	0.01207
-	82.008	-0.01476	0.01476	82.008	-0.01167	0.01167
-	82.051	-0.01415	0.01415	82.051	-0.01142	0.01142
95	82.051	-0.01415	0.01415	82.051	-0.01142	0.01142
-	82.095	-0.01384	0.01384	82.095	-0.01063	0.01063
-	82.139	-0.01351	0.01351	82.139	-0.01084	0.01084
-	82.182	-0.01320	0.01320	82.182	-0.01028	0.01028
-	82.226	-0.01313	0.01313	82.226	-0.01025	0.01025
-	82.270	-0.01560	0.01560	82.270	-0.01152	0.01152
-	82.313	-0.01565	0.01565	82.313	-0.01179	0.01179
-	82.357	-0.01455	0.01455	82.357	-0.01127	0.01127
-	82.400	-0.01332	0.01332	82.400	-0.00980	0.00980
-	82.444	-0.01247	0.01247	82.444	-0.00870	0.00870
-	82.488	-0.01153	0.01153	82.488	-0.00787	0.00787
-	82.531	-0.01104	0.01104	82.531	-0.00745	0.00745
-	82.575	-0.01089	0.01089	82.575	-0.00755	0.00755
-	82.618	-0.01119	0.01119	82.618	-0.00771	0.00771
-	82.662	-0.01137	0.01137	82.662	-0.00780	0.00780
-	82.706	-0.01140	0.01140	82.706	-0.00788	0.00788
-	82.749	-0.01174	0.01174	82.749	-0.00793	0.00793
-	82.793	-0.01218	0.01218	82.793	-0.00834	0.00834
-	82.837	-0.01284	0.01284	82.837	-0.00895	0.00895
-	82.880	-0.01347	0.01347	82.880	-0.00969	0.00969
-	82.924	-0.01417	0.01417	82.924	-0.01056	0.01056
96	82.924	-0.01417	0.01417	82.924	-0.01056	0.01056
-	82.967	-0.01474	0.01474	82.967	-0.01096	0.01096
-	83.011	-0.01513	0.01513	83.011	-0.01133	0.01133
-	83.055	-0.01476	0.01476	83.055	-0.01072	0.01072
-	83.098	-0.01429	0.01429	83.098	-0.01028	0.01028
-	83.142	-0.01385	0.01385	83.142	-0.00969	0.00969
-	83.185	-0.01331	0.01331	83.185	-0.00946	0.00946
-	83.229	-0.01294	0.01294	83.229	-0.00937	0.00937
-	83.273	-0.01266	0.01266	83.273	-0.00893	0.00893

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-	83.316	-0.01263	0.01263	83.316	-0.00882	0.00882
-	83.360	-0.01241	0.01241	83.360	-0.00853	0.00853
-	83.404	-0.01240	0.01240	83.404	-0.00871	0.00871
-	83.447	-0.01271	0.01271	83.447	-0.00891	0.00891
-	83.491	-0.01319	0.01319	83.491	-0.00945	0.00945
-	83.534	-0.01364	0.01364	83.534	-0.00979	0.00979
-	83.578	-0.01385	0.01385	83.578	-0.00967	0.00967
-	83.622	-0.01407	0.01407	83.622	-0.01000	0.01000
-	83.665	-0.01455	0.01455	83.665	-0.01052	0.01052
-	83.709	-0.01487	0.01487	83.709	-0.01107	0.01107
-	83.753	-0.01514	0.01514	83.753	-0.01150	0.01150
-	83.796	-0.01500	0.01500	83.796	-0.01146	0.01146
97	83.796	-0.01500	0.01500	83.796	-0.01146	0.01146
-	83.840	-0.01517	0.01517	83.840	-0.01094	0.01094
-	83.883	-0.01477	0.01477	83.883	-0.01076	0.01076
-	83.927	-0.01414	0.01414	83.927	-0.01006	0.01006
-	83.971	-0.01374	0.01374	83.971	-0.01002	0.01002
-	84.014	-0.01459	0.01459	84.014	-0.01048	0.01048
-	84.058	-0.01489	0.01489	84.058	-0.01112	0.01112
-	84.101	-0.01457	0.01457	84.101	-0.01132	0.01132
-	84.145	-0.01449	0.01449	84.145	-0.01074	0.01074
-	84.189	-0.01390	0.01390	84.189	-0.01034	0.01034
-	84.232	-0.01366	0.01366	84.232	-0.00982	0.00982
-	84.276	-0.01306	0.01306	84.276	-0.00939	0.00939
-	84.320	-0.01296	0.01296	84.320	-0.00925	0.00925
-	84.363	-0.01286	0.01286	84.363	-0.00902	0.00902
-	84.407	-0.01290	0.01290	84.407	-0.00931	0.00931
-	84.450	-0.01321	0.01321	84.450	-0.00967	0.00967
-	84.494	-0.01347	0.01347	84.494	-0.00996	0.00996
-	84.538	-0.01403	0.01403	84.538	-0.01023	0.01023
-	84.581	-0.01407	0.01407	84.581	-0.01010	0.01010
-	84.625	-0.01407	0.01407	84.625	-0.01021	0.01021
-	84.668	-0.01413	0.01413	84.668	-0.01023	0.01023
98	84.668	-0.01413	0.01413	84.668	-0.01023	0.01023
-	84.712	-0.01410	0.01410	84.712	-0.01065	0.01065
-	84.756	-0.01444	0.01444	84.756	-0.01070	0.01070
-	84.799	-0.01452	0.01452	84.799	-0.01070	0.01070
-	84.843	-0.01440	0.01440	84.843	-0.01062	0.01062
-	84.887	-0.01418	0.01418	84.887	-0.01037	0.01037
-	84.930	-0.01408	0.01408	84.930	-0.01016	0.01016
-	84.974	-0.01390	0.01390	84.974	-0.00996	0.00996
-	85.017	-0.01373	0.01373	85.017	-0.00990	0.00990
-	85.061	-0.01367	0.01367	85.061	-0.00992	0.00992
-	85.105	-0.01377	0.01377	85.105	-0.01001	0.01001
-	85.148	-0.01387	0.01387	85.148	-0.01008	0.01008
-	85.192	-0.01385	0.01385	85.192	-0.01011	0.01011
-	85.236	-0.01402	0.01402	85.236	-0.01020	0.01020
-	85.279	-0.01424	0.01424	85.279	-0.01032	0.01032

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-	85.323	-0.01441	0.01441	85.323	-0.01048	0.01048
-	85.366	-0.01429	0.01429	85.366	-0.01060	0.01060
-	85.410	-0.01434	0.01434	85.410	-0.01056	0.01056
-	85.454	-0.01424	0.01424	85.454	-0.01043	0.01043
-	85.497	-0.01416	0.01416	85.497	-0.01030	0.01030
-	85.541	-0.01405	0.01405	85.541	-0.01025	0.01025
99	85.541	-0.01405	0.01405	85.541	-0.01025	0.01025
-	85.584	-0.01408	0.01408	85.584	-0.01020	0.01020
-	85.628	-0.01407	0.01407	85.628	-0.01027	0.01027
-	85.672	-0.01402	0.01402	85.672	-0.01027	0.01027
-	85.715	-0.01410	0.01410	85.715	-0.01037	0.01037
-	85.759	-0.01514	0.01514	85.759	-0.01094	0.01094
-	85.803	-0.01505	0.01505	85.803	-0.01137	0.01137
-	85.846	-0.01481	0.01481	85.846	-0.01131	0.01131
-	85.890	-0.01483	0.01483	85.890	-0.01091	0.01091
-	85.933	-0.01443	0.01443	85.933	-0.01042	0.01042
-	85.977	-0.01374	0.01374	85.977	-0.00996	0.00996
-	86.021	-0.01341	0.01341	86.021	-0.00955	0.00955
-	86.064	-0.01324	0.01324	86.064	-0.00950	0.00950
-	86.108	-0.01318	0.01318	86.108	-0.00925	0.00925
-	86.151	-0.01305	0.01305	86.151	-0.00944	0.00944
-	86.195	-0.01301	0.01301	86.195	-0.00940	0.00940
-	86.239	-0.01334	0.01334	86.239	-0.00956	0.00956
-	86.282	-0.01366	0.01366	86.282	-0.00996	0.00996
-	86.326	-0.01409	0.01409	86.326	-0.01002	0.01002
-	86.370	-0.01409	0.01409	86.370	-0.01031	0.01031
-	86.413	-0.01420	0.01420	86.413	-0.01030	0.01030
100	86.413	-0.01420	0.01420	86.413	-0.01030	0.01030
-	86.457	-0.01417	0.01417	86.457	-0.01042	0.01042
-	86.500	-0.01518	0.01518	86.500	-0.01093	0.01093
-	86.544	-0.01531	0.01531	86.544	-0.01118	0.01118
-	86.588	-0.01509	0.01509	86.588	-0.01097	0.01097
-	86.631	-0.01473	0.01473	86.631	-0.01099	0.01099
-	86.675	-0.01474	0.01474	86.675	-0.01059	0.01059
-	86.719	-0.01463	0.01463	86.719	-0.01046	0.01046
-	86.762	-0.01414	0.01414	86.762	-0.01002	0.01002
-	86.806	-0.01376	0.01376	86.806	-0.00973	0.00973
-	86.849	-0.01367	0.01367	86.849	-0.00969	0.00969
-	86.893	-0.01371	0.01371	86.893	-0.00944	0.00944
-	86.937	-0.01359	0.01359	86.937	-0.00967	0.00967
-	86.980	-0.01354	0.01354	86.980	-0.00973	0.00973
-	87.024	-0.01373	0.01373	87.024	-0.01002	0.01002
-	87.067	-0.01416	0.01416	87.067	-0.01008	0.01008
-	87.111	-0.01422	0.01422	87.111	-0.01005	0.01005
-	87.155	-0.01433	0.01433	87.155	-0.01031	0.01031
-	87.198	-0.01472	0.01472	87.198	-0.01061	0.01061
-	87.242	-0.01513	0.01513	87.242	-0.01096	0.01096
-	87.286	-0.01505	0.01505	87.286	-0.01101	0.01101

