

HISTORY.

The subject of grade eliminations was first brought into the engineering limelight between 1895 and 1900 and in the next ten years many grades were eliminated in the larger cities, such as Chicago, New York, Philadelphia and Cleveland. The elimination of grades came almost directly as a sequel to the elevated electric lines, and in the larger cities many of the steam roads were brought into the heart of the city on embankments.

In the state of New York laws were passed apportioning the cost of such projects between the city, state and railroad; viz., one-half by the railroad, one-quarter by the city, and one-quarter by the state, but no proceedings can be taken by the commission until the state has appropriated its share.

In 1913 the state of New Jersey passed a law requiring all grade elimination projects to be at the sole expense of the railroad. Other states have provided for some impartial tribunal to arbitrate between the municipality and the railroad company and to proportion the cost. This arrangement has been provided for in New York, Massachusetts, Vermont and Ohio. The newly created Public Utilities Commission of Michigan could easily be assigned this duty.

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This not only helps in tracking expenses but also ensures compliance with tax regulations. The document further outlines the process of reconciling bank statements with the company's ledger to identify any discrepancies.

In the second section, the focus is on budgeting and financial forecasting. It provides a detailed breakdown of the company's budget for the upcoming fiscal year, including projected revenues, expenses, and profit margins. The document also discusses various strategies to optimize costs and improve overall financial performance.

The third section covers the company's financial policies and procedures. It details the approval process for capital expenditures, the handling of accounts receivable, and the management of accounts payable. The document also includes information on the company's credit terms and the procedures for resolving any disputes.

Finally, the document concludes with a summary of the key findings and recommendations. It highlights the areas where the company's financial performance is strong and identifies the key areas for improvement. The document also provides a clear path forward for the company's financial strategy.

It has become an accepted fact that whenever possible grade crossing should be eliminated regardless of cost: however, the cost has hitherto been the deciding factor.

If for no other reason, a railroad crossing should be eliminated for the protection of human lives. In the City of New York, with 400 grade crossings, from 1908 to 1911, 90 persons were killed and 136 injured. In many cases a series of serious accidents has awakened the public to the need of elimination of certain grade crossings, but in the case in hand, Providence together with an efficient gate tender, has averted recent serious accidents at this dangerous crossing. The crossing is termed dangerous because of the grade of the street east of the crossing and thus leading over the main lines of the Pere Marquette and Michigan Central railroads together with two sidings. The view of the tracks both north and south is blocked by permanent buildings together with a sharp curve in the main line of the P.M.R.R., to the south, and the station but 600 feet to the north.

This crossing has been recognized as dangerous by city officials and at various times investigations of the feasibility of the project have been started but no accidents have happened to awaken the city to

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serious action. Neither have the city officials realized that the municipality as well as the railroad is responsible for accidents at crossings as handed down in a ruling of the Supreme Court of Indiana.

At the time of writing the relaying of the pavement on Michigan Avenue is being agitated and with the new pavement may come serious consideration of eliminating this grade crossing.

FACTORS TO CONSIDER IN GRADE ELIMINATION.

In the design of a grade abolition project the first requirement is a topography of the immediate territory together with a basic understanding of the value of property involved, by these two the economy of design are controlled.

The question of whether the street is to cross over the railroad or vice versa is determined by considerations of economy, but it is not usually economical to depress the railroad since the railroad grades are usually limited to 0.57% while street grades vary from 2 to 7%. The railroad, since it pays the greatest portion of the cost, asks as a rule, for a 5 or 6% street gradient. For traffic reasons the city usually objects to anything over 3% which usually results in a compromise, streets on main thoroughfares being built with not over 3% grades, other streets having as high as 7% grade. In one case, in Fall River, Mass., 12% was allowed on account of the fact that this gradient existed on adjacent streets. The question of land damage enters into the question of street grades, and the two should be considered together.

The problem must be given careful study, and estimates of cost made if necessary, to determine which

of the following methods should be used: First, railroad elevation; second, railroad depression; third, street elevation; fourth, street depression; or a combination of railroad elevation with street depression or vice-versa. It must always be borne in mind, that, if railroad depression is adopted, the track must be lowered about 21 ft., 18 ft. for clearance and 3 ft. for bridge floors, while if track elevation is used, there is a change in grade to be made of about 17 ft, 14 for clearance and 3 ft. for bridge floors. Except in the case of sidetracks, which may be made 16 ft, these clearances are required in Mass., unless authorized otherwise by the Public Service Commission.

The points to be observed in an elimination of grade project may be summed up as follows: (1) Cost; (2) Discontinuance of important public ways or continuation of same involving real damage to property without redress at law; (3) drainage, railway and highway; (4) sewage flow, pipe changes, etc.; (5) street junctions; (6) minimum of taxable property to be devoted to new streets and ways; (7) traffic routes, vehicle and street railway, distances, grades and maximum avoidance of curves; (8) railroad grades should be slight at stations; (9) highway grades; (10) accessibility of stations to traffic, vehicular, street railway, and foot; (a) in grades, elevations and

layout, (b) station driveways and carriage yards;
(11) industrial sidetracks; (12) bridge headroom;
(13) minimum of land damage; (14) maintenance of
traffic during construction; (15) bridges and other
structures, strength, permanence, waterproofing;
(16) apportionment of work; (17) betterments.

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1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the integrity of the financial system and for the ability to detect and prevent fraud.

2. The second part of the document outlines the specific requirements for record-keeping, including the need to maintain original documents and to keep copies of all transactions. It also discusses the importance of regular audits and the need to report any discrepancies immediately.

3. The third part of the document discusses the consequences of failing to maintain accurate records, including the potential for fines and penalties. It also discusses the importance of training staff on proper record-keeping procedures and the need to establish a strong culture of integrity and transparency.

ARCHITECTURAL BEAUTY OF CONSTRUCTION.

From the architects standpoint the proper solution for a grade elimination problem would include a deck girder of unbroken span, together with an ornamental railing, but from the engineers standpoint this is grossly uneconomical.

It must be admitted that a through girder is not as sightly as a deck girder but it must be remembered that the lack of headroom influences the choice of the through girder, and the appearance of the deck girder would be entirely offset by the unsightly grades required by the higher elevation of the tracks.

By the use of column supports at the curb the clear span is broken but the depth of girder is cut and a much neater construction results regardless of the unsightly columns. Again the curb lines in most instances are cluttered with telephone poles and the like, and surely the columns make a better appearance than the other obstructions on the curb.

In some instances it has been attempted to cover the girders with ornamental castings as well as other means of disguise, but it has resulted in failure as far as artistic beauty is concerned.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions.

2. It is essential to ensure that all entries are supported by appropriate documentation and receipts.

3. Regular audits should be conducted to verify the accuracy of the records and identify any discrepancies.

4. The second part of the document outlines the procedures for handling cash and other assets.

5. All cash transactions should be recorded immediately and in full, including the date, amount, and purpose.

6. It is important to maintain a clear and organized system for tracking all assets and liabilities.

7. The third part of the document provides guidelines for managing the organization's budget.

8. A detailed budget should be prepared at the beginning of each fiscal year, outlining all expected income and expenses.

9. Regular monitoring and reporting of budget performance are necessary to ensure that the organization remains on track.

10. The fourth part of the document addresses the issue of financial reporting and transparency.

11. All financial statements should be prepared in accordance with the relevant accounting standards and regulations.

12. It is crucial to provide timely and accurate information to all stakeholders regarding the organization's financial health.

13. The fifth and final part of the document discusses the role of the board of directors in overseeing the organization's financial affairs.

14. The board should establish clear policies and procedures for financial management and ensure that they are strictly followed.

It has become an accepted practice, that where headroom is limited, a through girder with the end panels rounded off in an arc shall be used.

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PROPERTY DAMAGE AND IMPROVEMENT.

When the street grades are changed in a settled district, it necessarily follows that property damage must occur, and the law provides that such property shall be compensated for to the amount of the damage.

In many of the first grade eliminations property damage was paid for in cash, and many property owners made claim for such, claiming the need of retaining walls, but after receiving the cash no walls or grade slopes were made. The law gives the city no power to enter upon private lands in order to build retaining walls or grade slopes, but the method now used is to make this work one of the conditions of the damage settlements.

It is obvious that in cases where the street is depressed there will be some property standing so high above the street as to be unsightly. In some cases this property will not be of sufficient value to warrant the expenditure of any great sum for improvements. In our case there are four frame residences on the south side of Michigan Avenue between the tracks and Hosmer street which we recommend for condemnation, as they now stand approximately eight feet above the present grade of the street and would not warrant any great

expenditure, since with the growth of Lansing the business district would soon extend over this property and the land could then be excavated. As to the other property on Michigan Avenue the city when laying the new pavement should be required to put in the slope grades where necessary. Going west on Michigan Avenue from the tracks there are no commercial buildings that will be affected; all merchandise being brought in and delivered from the alley at the rear. A driveway would be necessary for vehicular traffic to and from the depot as well as a driveway to the Michigan Central freight house.

In considering the damage done by raising the bed of the railroad little will be done as the tracks are not flanked on each side by higher land. The Union Station having been built at the present grade must be augmented by a loading platform built at the new grade. Although this will cause a slight inconvenience to traffic, the present depot will soon be outgrown and the new station can be built at the proper grade.

As compared with grade elimination problems of the past, the project in hand presents little difficulty from the standpoint of property damage.

PRELIMINARY SURVEY

In considering a problem of grade elimination one of the most important features of the work is the preliminary surveying.

On the preliminary survey is based the feasibility of the project. That is, it determines whether or not economical grades can be used and the character of both surface of land and of the soil in the immediate vicinity.

The operations for the survey are as follows:

- First - Determining the line.
- Second - Getting the levels for profiles.
- Third - Determining the topography of the land.
- Fourth - Fixing the grades.
- Fifth - Estimating the excavation.
- Sixth - Taking a survey of the traffic.

We first laid the lines. The first line was run for 14 stations north and south on the P.M.R.R. The starting point was taken on a manhole 9 feet east of the east rail of the P.M.R.R., 23 feet east of the east rail of the M.C.R.R., and 32'8" north from the center line of the city electric railway line and fifty feet from the south west corner of the railway freight depot. This manhole was used as the starting point for

The following text is a transcription of a document, likely a list or index, containing various entries and their corresponding page numbers. The text is organized into several sections, with some entries marked by bullet points and others by numbers.

The entries are as follows:

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all the transit work and as a bench mark for the leveling. The line run on Michigan Avenue was run on the north curb line. Both lines were stationed every 100 ft. The transit work on this survey was very simple and took very little time of the total survey.

The next operation that was undertaken was that of running levels for obtaining the profiles in order to set the grades. The first levels were taken at every station to fix the grade and cross sections were taken. This was practically all that was done in straight level work.

The biggest job we had was taking the topography of the land in the vicinity. The territory covered in this survey is bounded on the north by Shiawassee St., the east by Pennsylvania Avenue, the south by Kalamazoo St., and the west by Larch St. This comprises an area of about one square mile. Two separate surveys were made, the plot being divided into two parts, one east of the railway and the other on the west side.

On the east side there were no problems that presented very great difficulties. On the south side of Michigan Avenue, beginning at the track is a terrace about ten feet high. This terrace gradually decreases until it comes to grade on Kerr, St.

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The situation on this side of this is shown very well in picture number one.

On the north side at the corner of Michigan Avenue and Hosmer St., there is an excavation of about ten feet. East of this excavation there is a low terrace which will not interfere with this project. Picture number two shows a view of Michigan Avenue east of the railroad. It also shows how the street railway service is impeded as the conductor has to leave the car and close the derailer every time before crossing the railroad tracks.

Michigan Avenue, west of the tracks is shown in picture number three. The grade of the street drops about five feet in 1200. There are no buildings of any value on the south side in the first block which is the only one that will be affected. This side of the street is occupied by a lumber company which can get their entrance from the rear. On the opposite side of the street there are some business structures but they are of little importance and can have their entrance from the rear. The land rises gradually on both sides of the street going from Michigan Avenue.

Next taking the railroad going north which is shown in picture number four, the grade of the railroad drops slightly for about 3000 feet and then begins to rise

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again. The grade is five tenths of one percent. On the east side there is a slight rise in the land and on the west the land is nearly level. There will be no difficulty in raising the tracks on this side of Michigan Avenue.

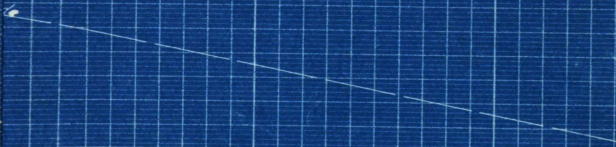
The railroad on the south is level for about 700 feet. The P.M.R.R., and M.C.R.R. separate here, the M.C.R.R. going straight ahead, while the P.M.R.R. turns and goes southeast. The M.C.R.R. has a grade that is level for 900 feet more and then drops slightly. The P.M.R.R. rises about six feet in the next 900 feet. On both sides there are banks running up to about 12 feet. This is perfectly adapted for a rise in the tracks. Picture number five shows the railroad looking south from Michigan Avenue.

Picture number six is a view of the union station. This view shows that when the railroad is raised the station must be raised or a loading platform installed. In order to keep the cost down as low as possible we have decided on installing the loading platform.

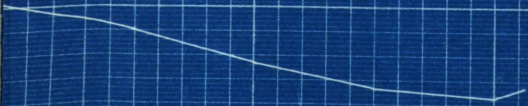
The survey showed that the most economical construction was to raise the tracks slightly and lower the street to get the required head room.

The level and stadia notes are in the pocket in the back of the book.

3 10 11 12 13 14



Note:-
The new grade will come
to the present grade of
the R.R. at Sta. 61.



Grade Elimination
Showing R.R. Grades.
Present Grade —————
New Grade

11

12

13

Grade Elimination
Present Grade _____
New Grade _____
Michigan Ave. - M.U.T.

TRAFFIC SURVEY.

On April 3rd, we took a traffic survey between the hours of 5:00 and 6:00 P.M. We decided to take the survey at this time as it is the busy hour for traffic. The results of this survey are tabulated below:

KIND OF VEHICLE	NUMBER
Pleasure cars - - - - -	536
Trucks 1/2 ton - - - - -	56
Trucks 1 ton - - - - -	24
Trucks over 1 ton - - - - -	4
Horse drawn vehicles- - - - -	14
Street Cars - - - - -	26
Interurbans - - - - -	<u>6</u>
TOTAL- - - - -	666

These results show that the elimination of this crossing will be necessary with constant increase in the growth of the population in Lansing.

THE UNIVERSITY OF CHICAGO

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DESIGN OF ABUTMENTS AND RETAINING WALLS.

An abutment in its simplest form is a retaining wall terminating the approach embankment to a bridge and provided with a bridge seat for the end of the first span to rest upon.

There are several classes of abutments and they are classified below according to the general forms as follows:

1. Pier abutments,
2. Wing abutments,
3. Cellular abutments,
4. U - Abutments,
5. T - abutments,
6. Buried pier abutments,
7. Skeleton and arch abutments.

After studying the various forms of abutments we finally decided on the U - abutment. We did this because of the limited space we had on each side of the track. On the west side it was necessary to put in a retaining to keep the fill from spreading to the Station and parking space.

The U - abutment gets its name from its shape. The wing walls are placed at right angles to the face wall and are usually 1-1/2 times as long as it is high. In this case however the wing walls are considerably

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longer. The batter is usually 2 inches in 12 to provide for frost expansion.

Abutments may fail in three ways:

1. By sliding forward,
2. By overturning,
3. By crushing.

There is very little chance of the abutments failing by the first two causes mentioned above, so failure by crushing was investigated.

The mathematical theory of the pressure of the earth being uncertain it is not customary to compute the stability of the abutment. The thickness of the wall at the top of the footing is generally taken as 0.4 of the height of the abutment. The thickness of the wing walls is generally taken as 0.3 of height. Trantwine recommends that for a backing of gravel the thickness be increased $1/8$ to $1/5$ part, which was done in our case.

The footing area depends upon the bearing power of the soil and is determined by any one of various empirical formulas that have been discovered. The soil at the location of our project is well packed sand and clay. The formulas follow on another page.

All of the data and formulas for computing the abutment will be found on the page following:

1. The first part of the document discusses the importance of maintaining accurate records of all transactions.

2. It also emphasizes the need for transparency and accountability in financial reporting.

3. The document further outlines the various methods used to collect and analyze financial data.

4. Additionally, it provides a detailed overview of the different types of financial statements and their components.

5. The document also discusses the role of internal controls in ensuring the accuracy and reliability of financial information.

6. Furthermore, it highlights the importance of regular audits and the role of external auditors in providing an independent assessment of the financial statements.

7. The document concludes by emphasizing the need for ongoing monitoring and evaluation of financial performance to ensure long-term success.

8. Finally, it provides a summary of the key findings and recommendations for improving financial reporting practices.

9. The document is intended to serve as a comprehensive guide for anyone involved in financial reporting and management.

10. It is hoped that this document will provide valuable insights and practical advice to help organizations achieve their financial goals.

11. The document is available for download at the following link: [\[Link\]](#)

12. For more information, please contact our support team at [\[Email\]](#) or [\[Phone\]](#).

13. We are committed to providing high-quality content and services to our readers and customers.

14. Thank you for your interest and support. We look forward to serving you in the future.

15. The document is part of our ongoing series of articles on financial reporting and management.

16. We will continue to provide you with the latest news and insights in this field.

17. Stay tuned for more updates and articles from our team.

18. We are proud to be a part of the financial reporting community and to share our knowledge with you.

19. Your feedback and comments are always welcome. Please let us know how we can improve our content.

20. We are committed to providing you with the best possible experience and information.

21. Thank you again for your support and interest. We look forward to seeing you again soon.

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RETAINING WALLS.

The retaining walls are designed as for the abutment. However the retaining wall designed for this problem is reinforced, therefore it has been made considerably thinner. The height of the wall is only seven feet with a back fill of five feet leaving a rail of two feet to prevent trucks and automobiles from plunging over into the car tracks.

The formulas and data follow:+

Angles of Repose and Weights per Cu.Ft. for Various Earths.

<u>Material</u>	<u>Slope</u>	<u>Angle of Repose Degrees.</u>	<u>Weight in lbs. per cu. ft.</u>
Sand, dry	2.8:1 to 1.4:1	20 - 35	90 - 110
Sand, moist	1.75:1 to 1:1	30 - 45	100 - 110
Sand, wet	2.8:1 to 1.2:1	20 - 40	110 - 120
Ordinary earth dry	2.8:1 to 1:1	20 - 45	80 - 100
Ordinary earth, wet	2.1:1 to 1.75:1	25 - 30	100 - 120
Gravel, round to angular	1.75:1 to 0.9:1	30 - 48	100 - 135
Gravel, sand and clay	2.8:1 to 1.3:1	20 - 37	100 - 115

From Cain's "Earth Pressure, Walls and Bins",
page 9.

The first part of the document discusses the importance of maintaining accurate records of all transactions. This includes not only sales and purchases but also any other financial activities that may occur. It is essential to ensure that all entries are properly documented and supported by appropriate evidence.

In addition, the document emphasizes the need for regular reconciliation of accounts. This process involves comparing the company's internal records with the bank statements to identify any discrepancies. By doing so, the company can ensure that its financial statements are accurate and reliable.

Finally, the document highlights the importance of maintaining a clear and organized system for storing financial records. This can be achieved by using a consistent naming convention for files and folders, as well as by backing up data regularly to prevent loss.

Appendix A: Sample Financial Statement

Account	Balance	Debit	Credit	Balance
Accounts Receivable	1000			1000
Accounts Payable		500		500
Inventory	200			200
Fixed Assets	500			500
Equity			1200	1200
Total	1700	500	1200	1700

Coefficients and Angles of Friction Between Earth and
Other Materials.

Materials	f = ton	ϕ
Masonry on masonry	0.65	33°
Masonry on wood, with grain	0.60	31°
Masonry on wood, across grain	0.50	26°40'
Masonry on dry clay	0.50	26°40'
Masonry on wet clay	0.33	18°20'
Masonry on sand	0.40	21°50'
Masonry on gravel	0.60	31°

From Haul and Johnson, page 582.

The safe bearing power of gravel and sand well packed in short tons per square foot is 8 as a minimum and 10 as a maximum.

Computations for Retaining Walls. Coulombs Formula for
Earth Pressure.

$$E = 1/2 wh^2 \tan^2 (45^\circ - 1/2 \phi)$$

Where w = weight of cubic unit of earth

 h = vertical height of wall

ϕ = angle of repose.

$$E = 1/2 115 \times 5^2 \times \tan^2 (45^\circ - 30^\circ/2)$$

$$= 57.5 \times 25 \times \tan^2 30^\circ$$

$$= 57.5 \times 25 \times \underline{0.57735^2}$$

$$= 478.2$$

The thickness of the wall was taken as $1/3$ of the height of wall making it about 1 foot 6 inches.

Computations for the Abutment.

Height of wall from footing to bridge seat is 12 ft. There are no set formulas that are followed in designing the abutment, but constants of recognized value are used.

$$12 \times 4/10 = 4.8' \text{ wide.}$$

Using a factor of safety of $1/2$ we have 7'0" as the thickness used.

The abutment has $3/4$ " weep holes and the backing is of cinder to facilitate the drainage.

Footings

The bearing power of the soil is from 16,000 to 20,000 pounds per square foot. From constants obtained in various handbooks on concrete construction we have the depth equal to five feet and the width equal to eight feet.

$2000 \times 8 \times 8 = 128000\frac{1}{2}$ which is weight footing will hold.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is essential for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent and reliable data collection processes to support effective decision-making.

3. The third part of the document focuses on the role of technology in data management and analysis. It discusses how modern software solutions can streamline data collection, storage, and reporting, thereby improving efficiency and accuracy.

4. The fourth part of the document addresses the challenges associated with data management, such as data quality, security, and privacy. It provides strategies to mitigate these risks and ensure that data is used responsibly and ethically.

5. The fifth part of the document concludes by summarizing the key findings and recommendations. It stresses the importance of ongoing monitoring and evaluation to ensure that data management practices remain effective and aligned with the organization's goals.

6. The sixth part of the document provides a detailed overview of the data management framework, including the roles and responsibilities of various stakeholders. It also outlines the key performance indicators (KPIs) used to measure the success of the framework.

7. The seventh part of the document discusses the future directions of data management, including the integration of artificial intelligence and machine learning. It also highlights the need for continuous learning and adaptation to stay ahead of the curve.

Appendix

1. The first appendix provides a detailed list of the data sources used in the study, including internal databases, external surveys, and public records. It also includes information on the data collection methods and the time period covered by the data.

2. The second appendix contains a list of the abbreviations and acronyms used throughout the document. This is intended to help readers understand the terminology used in the text and avoid confusion.

3. The third appendix provides a list of the references used in the study. This includes books, articles, and other sources that have been consulted to support the research and provide context for the findings.

$$M_{\text{mom}} = C_2 d P$$

Where

d = length of longest side,

P = applied force,

a = depth of column

b = breath of footing

$$\begin{aligned} C_2 &= 1/24 (2 + a/b) (1 - a/d)^2 \\ &= 1/24 (2 + \frac{1.25}{8.00}) (1 - \frac{1.25}{8.00})^2 \\ &= 1/24 (2 + .156) (1 - .156)^2 \\ &= 1/24 (2.156) (.844)^2 \\ &= 1/24 \times 2.156 \times .71 \\ &= 0.63 \end{aligned}$$

$$\text{Mom} = 0.63 \times 8 \times 60000$$

$$= 300,000\frac{1}{2}$$

QUESTION 1

- $1000 \times 1.05^2 = 1102.50$
- $1000 \times 1.05^3 = 1157.63$
- $1000 \times 1.05^4 = 1216.77$
- $1000 \times 1.05^5 = 1280.08$

$$(1000 \times 1.05^2) \times 1.05 = 1157.63$$

$$(1000 \times 1.05^3) \times 1.05 = 1216.77$$

$$(1000 \times 1.05^4) \times 1.05 = 1280.08$$

$$1000 \times 1.05^5 = 1280.08$$

$$1000 \times 1.05^6 = 1344.08$$

$$1000 \times 1.05^7 = 1411.28$$

$$1000 \times 1.05^8 = 1482.84$$

$$1000 \times 1.05^9 = 1558.98$$

DESIGN OF THE RAILROAD BRIDGE.

Because of limited head room it was decided to use a through plate girder bridge with columns just inside the curb lines, making a span of 80 ft. between centers of supports. And taking Waddell as an authority but two girders are to be used for the double track bridge. The two sidings also at the crossing being changed.

The live load was taken as two consolidation locomotives and train per track, or an alternative load of 120,000 pounds equally distributed on two pair of driving wheels, spaced 6 feet center to center. This loading is known as Cooper's Standard Class E50. The allowance for impact due to live load was taken from Waddell's formula:

$$I = 400 L (L + 500) \text{ or } 80 \%$$

As the economic depth of plate girders varies, and the average being the reciprocal of 10.5, 90 inches was taken as the depth of the girder.

The girders were spaced 28 ft. 9 in. on centers with 12 ft. between the tracks.

No attempt shall be made in this thesis to make a final design but proposal drawings and computations are included herein as an aid to cost computation.

(See pocket on rear cover.)

THE HISTORY OF THE UNITED STATES

The history of the United States is a story of growth and change. From the first settlers to the present day, the nation has evolved through various stages of development. The early years were marked by exploration and settlement, followed by a period of territorial expansion and the struggle for independence. The American Revolution led to the formation of a new government, and the subsequent years saw the nation expand its territory and influence across the continent. The Civil War was a pivotal moment in the nation's history, leading to the abolition of slavery and the strengthening of the federal government. The late 19th and early 20th centuries were characterized by industrialization, urbanization, and the rise of a new political order. The 20th century has seen the United States emerge as a global superpower, with significant involvement in international affairs and the development of a complex social and economic system.

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BRIDGE COMPUTATIONS.

LOADING

Cooper's Class E50.

WEB

Max. live load shear - - - - -	310,200
Impact 80 % - - - - -	248,160
Wt. 1 girder + 1/2 floor	55000.
Wt. 1/2 track - - - - -	<u>37600</u>
1/2 Dead load =	92600 ‡
Dead load shear - - - - -	<u>46,300</u>
Total vertical shear - - - - -	604,660 ‡

Unit shear stress = 12,000.

Area web = 50.4 sq. in.

Depth of girder = 90 inches.

Thickness web = .55 in.

Use 5/8 x 90" plate.

FLANGE

Max. moment l.l. - - - - -	5,406,000.
Impact - - - - -	4,324,800.
Dead load moment - - - - -	<u>926,000.</u>
Total bending mom- - - - -	10,656,800. ft. lbs.
Total bending mom- - - - -	127,881,600. in. lbs.

Effective depth of girder = 90 + .25 - 1.5 = 88.75 in.

Unit tensile strength = 17,000 lbs. per sq. in.

Assume 12 % gross web section as effective flange area.

$$A = \frac{10,656,800 \times 12}{17,000 \times 88.75} - (0.12 \times 5/8 \times 90) = 85.2 - 6.75$$

Net area of lower flange = 78.45 sq. in.

<u>USE</u>	2 - 8 x 8 x 1 1/8" LS	2 - 1" holes =	31.21
	3 - 20 x 7/8" plates	2 - 1" holes =	<u>47.25</u>
			78.46 sq. in.

STIFFENERS.

Max. floor load - - - - -	60,000 lbs.
Impact- - - - -	<u>48,000.</u>
	108,000. lbs.
Unit fiber stress - - - - -	16,000. lbs.
Sectional area- - - - -	6.75 sq. in.

USE 8 x 3 1/2 x 1/2" LS

END STIFFENERS.

Vertical shear- - - - -	600,000. lbs.
$\frac{600,000}{15,000}$	= 40 sq. in.

USE 4 - 8 x 3 1/2 x 1/2" LS

1. The first part of the document discusses the importance of maintaining accurate records of all transactions.

2. It is essential to ensure that all entries are supported by appropriate documentation and receipts.

3. Regular audits should be conducted to verify the accuracy of the records and identify any discrepancies.

4. The second part of the document outlines the procedures for handling disputes and resolving conflicts.

5. It is important to establish clear communication channels and protocols for addressing any issues that arise.

6. The third part of the document provides a detailed overview of the financial statements and their components.

7. This section includes a breakdown of the income statement, balance sheet, and cash flow statement.

8. The fourth part of the document discusses the various risks associated with the business and how they can be mitigated.

9. It is crucial to identify potential risks and implement effective risk management strategies to protect the organization's assets.

10. The fifth part of the document concludes with a summary of the key findings and recommendations.

11. It is recommended that the organization continue to monitor its financial performance and adapt to changing market conditions.

12. The final part of the document provides a list of references and sources used in the report.

13. This section includes a list of relevant literature, industry reports, and other sources that provide additional context and information.

14. The document is intended to provide a comprehensive overview of the organization's financial and operational performance.

15. It is hoped that this report will be helpful in making informed decisions and improving the overall performance of the organization.

LATERAL BEAMS.

WEB

Live load shear- - - - -	120,000.
Impact 80 %- - - - -	96,000.
Dead load shear- - - - -	<u>4,000.</u>
Total shear- - - - -	220,000. lbs.
Unit shear stress- - - - -	12,000. lbs.
Area web - - - - -	18.33 sq. in.
Depth girder - - - - -	30 in.
Thickness web- - - - -	.61 in.

USE 30 x 5/8" plate.

FLANGE $M = \frac{W_s}{2} = 120,000 \times 8/2 = 480,000.$

Max. mom. l.l. - - - - -	480,000.
Impact - - - - -	384,000.
Dead load mom. - - - - -	<u>100,000.</u>
Total bend. mom- - - - -	964,000. ft. lbs.
Unit tensile strength- - - - -	17,000. lbs/sq.in.

Assume 12 % gross web section as flange area.

$$A = \frac{964,000 \times 12}{17,000 \times 29} - (0.12 \times 5/8 \times 30) = 23.5 - 2.25$$

Net area lower flange = 21.25 sq. in.

USE (2 - 6 x 6 x 3/4" LS
(
(1 - 12 x 3/4" plates

Reinforced Concrete Stringers.

$$M = \frac{wl}{4} + \frac{100,000 \times 10}{4} = 250,000.$$

$$M_o = p f s j b d^2$$

$$250,000 = .0077 \times 16,000 \times 7/8 \times 10 \times d^2$$

d = 15.5" depth of girder

3.5" ; steel protection.

USE 10 x 18 inch concrete beam.

$$a_g = p b d = .0077 \times 10 \times 15.5 = 1.2 \text{ sq. in.}$$

USE Trough formed of

3 x 3 x 1/4" LS

1/4 x 18" plate

1/4 x 10" plate.

QUESTION 1

1.1. The following table shows the results of a survey of 1000 people.

Age Group	Male	Female	Total
18-24	150	130	280
25-34	200	180	380
35-44	180	160	340
45-54	120	110	230
55-64	80	70	150
65-74	40	30	70
75+	20	10	30
Total	790	710	1500

1.2. Calculate the probability that a person selected at random is:

- Male
- Female
- Under 35 years old
- Over 64 years old

1.3. Calculate the probability that a person selected at random is:

- Male and under 35 years old
- Female and over 64 years old
- Male or over 64 years old
- Female and under 35 years old

QUESTION 2

2.1. A bag contains 10 balls, 3 of which are red and 7 are blue. Two balls are drawn at random without replacement. Calculate the probability that:

- Both balls are red
- One ball is red and one is blue
- Both balls are blue

QUESTION 3

3.1. A die is thrown twice. Calculate the probability that the sum of the two throws is:

- 7
- 12
- Less than 7

FLOOR

(136 - 1/4 x 18" Pl - 10' - 0" lg) at 15.3 =	10,400
(272 - 1/4 x 10" Pl - 10' - 0" lg) at 8.5 =	11,550
(544 - 3 x 3 x 1/4" LS - 10' - 0" lg) at 4.9 =	<u>13,350</u>
	<u>35,300.</u>

Rivets, clips, splices, etc. 7 % =	113,024
	<u>7,912</u>

Total wt. = 120,936

SIDEWALKS GIRDER

1 - 3/8" x 36" Pl. 14' - 0" lg at 45.9 =	643
4 - 6 x 6 x 1/2"L - 14' - 0" lg at 19.6 =	1,100
2 - 13 x 1/2" Pl. - 14' - 0" lg at 22.1 =	617
10 - 3 1/2 x 5 x 3/8"LS - 3' - 0" lg at 10.4 =	<u>312</u>
	2,672.

FLOOR

17 - 1/4 x 18" Pl. - 14' - 0" lg at 15.3 =	3,640.
34 - 1/4 x 10" Pl. - 14' - 0" lg at 8.5 =	4,050.
68 - 3 x 3 x 1/4" LS - 14' - 0" lg. at 4.9 =	<u>4,670.</u>
	<u>12,360.</u>

15,032.

Rivets, clips, etc. 7 % =	<u>1,050.</u>
---------------------------	---------------

Total Wt. = 16,082.

Total wt. of steel in 1/2 bridge = 137,018. lbs.

Approximate 140 tons.

Estimate of Concrete.

1.- ABUTMENT

$42.5 \times 8 \times 5$	13 =	1,700.
$42. \times 10.67 \times 7$	=	3,135.
$6.3 \times 39.6 \times 1.5$	=	374.
$2.2 \times 36. \times 2$	=	<u>159.</u>
		5,368. cu.ft.
$\times 2 =$		400 cu. yds.

1.- RETAINING WALLS. (Road Bed)

North side	$(3.42 \times 5 \times 400 =$ $(2.2 \times 6 \times 400 =$	6,840. 5,280.
South side	$(3.42 \times 5 \times 20 =$ $(2 \times 2 \times 6 \times 20 =$	342. <u>264.</u>
		12,726. cu.ft.
		470 cu. yds.

RETAINING WALLS. (Protection Property) = 6,000 cu.ft.

225 cu.yds.

RETAINING WALLS. (Street railway)

East	$[(1 \times 4.0) + (1.5 \times 6)]$	900 = 11,700 cu. ft.
West	$[(1 \times 4.0) + (1.5 \times 4)]$	400 = <u>4,000 cu. ft.</u>
		15,700 cu. ft.
$\times 2 =$		1,165 cu. yds.

1. $\frac{1}{x^2} = x^{-2}$

2. $\frac{1}{x^3} = x^{-3}$

3. $\frac{1}{x^4} = x^{-4}$

4. $\frac{1}{x^5} = x^{-5}$

5. $\frac{1}{x^6} = x^{-6}$

6. $\frac{1}{x^7} = x^{-7}$

7. $\frac{1}{x^8} = x^{-8}$

8. $\frac{1}{x^9} = x^{-9}$

9. $\frac{1}{x^{10}} = x^{-10}$

10. $\frac{1}{x^{11}} = x^{-11}$

11. $\frac{1}{x^{12}} = x^{-12}$

12. $\frac{1}{x^{13}} = x^{-13}$

13. $\frac{1}{x^{14}} = x^{-14}$

14. $\frac{1}{x^{15}} = x^{-15}$

COLUMN FOOTINGS

$$8 \times 5 \times 32 \times 2 =$$

2,560 cu. ft.

95 cu. yds.
BRIDGE FLOORBRIDGE BEAMS

$$108. \times 30. \times .3 =$$

972.

$$. 17 \times 8 \times 1.5 \times .83 \times 10 =$$

1,690.

$$17 \times 2 \times 1.5 \times .83 \times 14 =$$

593.

3,255 cu. ft.

120 cu. yds.

Total Concrete =

2,475. cu. yds.

DRAINAGE

The drainage of the bridge floor will be well taken care of by sloping the three inch concrete floor to the center line of the bridge, and laying in a 4 inch tile longitudinally, with a stand pipe at the north end of the bridge.

The present drainage of the street will be useless with the new grade, and another sewer must be constructed. At the present time there is a 20" x 33" egg-shaped sewer laying 7 foot 8 inches beneath grade which drains this section of Michigan Avenue. This sewer is not properly constructed and has never given efficient service so the loss will not be deeply felt by the municipality.

The writers recommend that a 30 inch tile drain be put in sufficiently below the frost line, and to run from the center of the crossing west to Larch Avenue and thence down Larch to Shiawassee and from there to the river.

Other changes to be made below grade will include the conduits of the Michigan State Telephone Company, the gas mains, and the water mains. However, these changes involve no direct cost to the project in hand as the lines are under pressure and do not depend on grade for their flow.

1. The first step in the process of identifying a problem is to recognize that a problem exists. This is often done by comparing current performance with a desired state or goal. For example, a manager might notice that sales are declining or that customer satisfaction is low. Once a problem is identified, the next step is to define it more precisely. This involves determining the scope of the problem, its causes, and its effects. For instance, a manager might define a sales decline as a 10% drop in revenue over the last quarter, caused by a decrease in the number of new customers and a loss of existing customers. The third step is to analyze the problem. This involves gathering data and information about the problem and its causes. For example, a manager might conduct a market survey to determine why customers are leaving or why sales are declining. The fourth step is to generate alternative solutions. This involves brainstorming different ways to solve the problem. For example, a manager might consider increasing marketing efforts, improving customer service, or offering discounts. The fifth step is to evaluate the alternatives. This involves comparing the different solutions and determining which one is the most feasible and effective. For example, a manager might compare the costs and benefits of each solution and choose the one that offers the best return on investment. The sixth step is to implement the chosen solution. This involves putting the solution into action and monitoring its progress. For example, a manager might launch a new marketing campaign and track its results. The seventh step is to evaluate the results. This involves comparing the actual results with the expected results and determining whether the problem has been solved. For example, a manager might compare sales figures before and after the marketing campaign. If the problem has not been solved, the manager may need to go back to an earlier step in the process. The process of identifying a problem is an ongoing one, as new problems may arise at any time. Therefore, it is important for managers to be constantly aware of their organization's performance and to be ready to identify and solve problems as they arise.

ESTIMATE OF COST.

140 tons fabricated steel at .07 =	\$ 19,600.00
2,475 cu. yds. concrete at \$10 =	24,750.00
31,740 cu. yds. excavation)	
28,520 cu. yds. fill)	at 1.00 = 32,000.00
	<hr/>
	\$ 76,350.00
Labor = 40 %	<hr/>
	30,540.00
Total cost (not including pavement) =	\$106,890.00

FEASIBILITY OF PROJECT.

After conducting the thorough investigation herein contained, the writers agree that the project is, entirely feasible, for the following reasons:

1. The grades used in this problem have not exceeded the limiting grades as established in other projects of this nature. It has been stated elsewhere in this thesis that the recognized maximum grade of paved street approaches is 3 1/2 % and so this was used as the maximum. In changing the grade of railroads the limiting grade is taken as the maximum grade on that line. In this case a 1 % grade was found, which is greater than the usual maximum of .57 %, but the conditions as stated will allow the 1 % maximum grade which was used.
2. The damage of property caused by the change of grades, is very low as compared with that done in similar work in other cities. Only four frame dwellings must be condemned and the slope grades along the other part of the street are not extreme.
3. The changes required by the construction outlined are not prohibitive. The loading plat-

form at the station, altho a slight inconvenience to traffic, can be used until a new station is required which with the present growth of Lansing is not far distant.

The change of industrial sidings which will be required, will cause cars to be switched in from either side of Michigan Avenue at the present grade, leaving only the two main lines to cross the street.

The Hosmer street paving will have to be torn up for about 200 feet south of Michigan and brought down to the new grade of Michigan Avenue. The same will apply to Larch Avenue on both the north and south sides. Shiawassee Street must be torn up for about 200 feet east and west of the tracks and brought to the new grade of the tracks.

Traffic on Michigan Avenue can be diverted during construction either down Kalamazoo street or Shiawassee street. Railroad traffic can be continued over a temporary trestle as has been done in similar cases.

4. The cost of this project must be considered reasonable as the much needed relaying of Michigan Avenue cannot be directly applied to the project.

The division of cost would have to be

settled by a board of arbitration, and the writers do not favor the apportionment as used in the State of New York, but suggest that the state be required to pay 20%, the city 40%, and the railroad 40% of the total cost which is estimated at about \$125,000.00.

Of the entire number of grade crossings in the United States it is estimated that 30% of them may be termed dangerous and should be eliminated, and the abolition of these crossings is rapidly taking place. It has been shown herein that this crossing is classed among the 30% and the writers recommend that the City of Lansing proceed at once to eliminate this menace to public safety.

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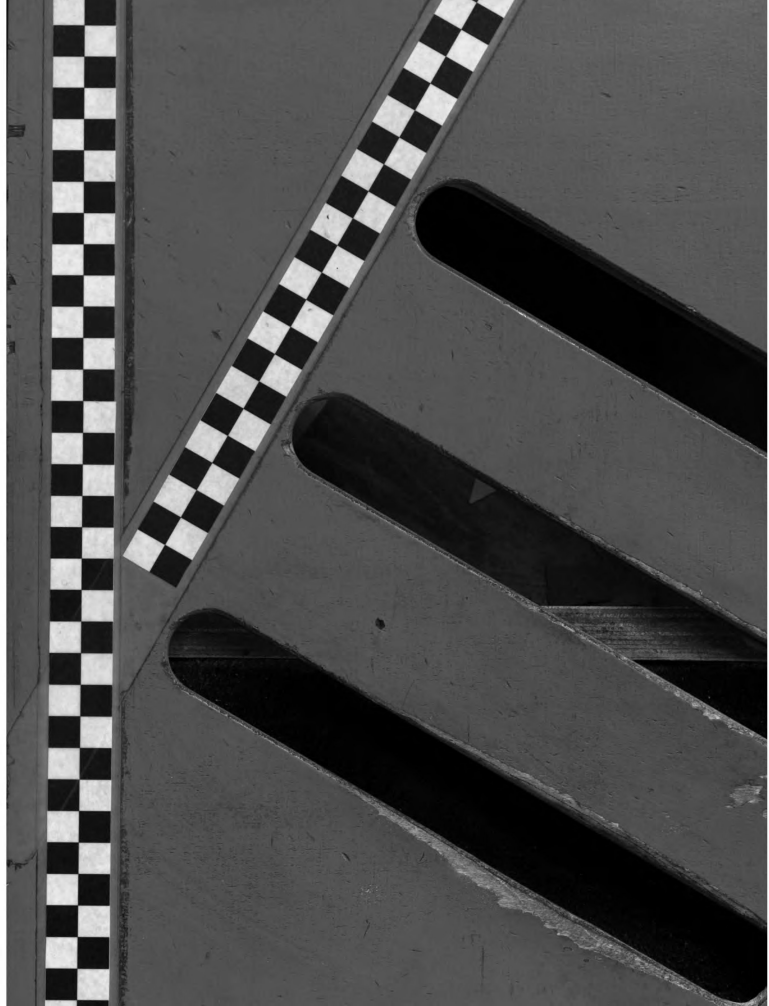
CONTENTS OF VOLUME.

- "A" Elevation and plan of Project. (Blue Print and Tracing)
- "B" Details of Bridge and Abutment. (Blue Print and Tracing)
- "C" Topography of Location. (Blue Print and Tracing)
- "D" Profile Sheets.
- "E" Field Notes.

MICHIGAN STATE LIBRARIES



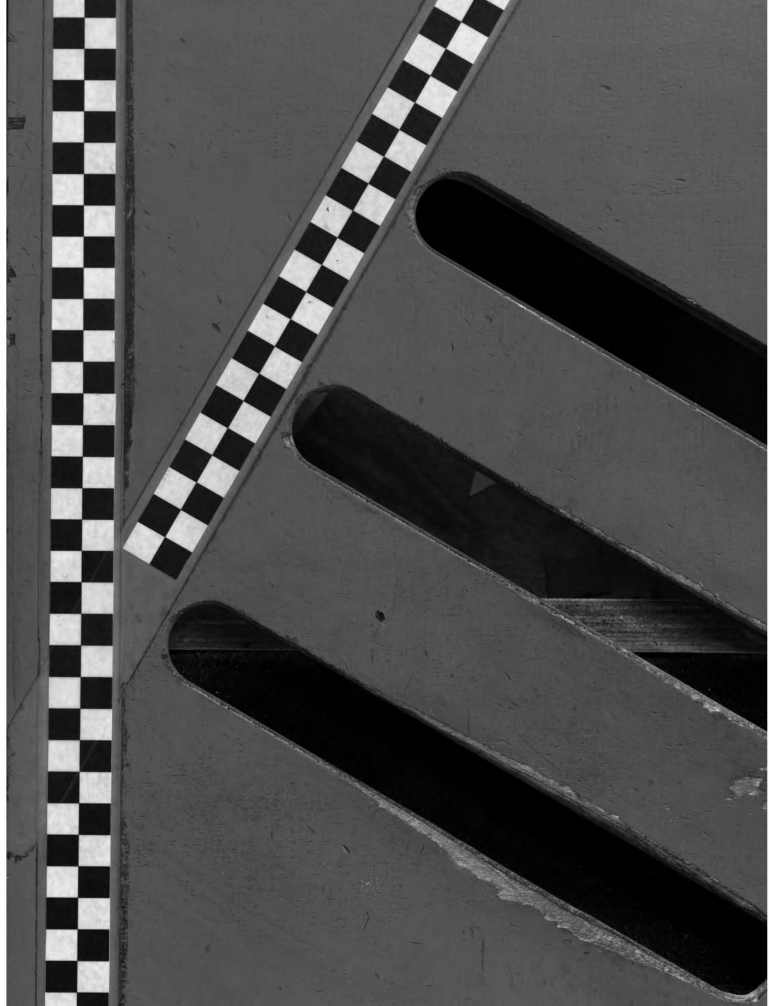
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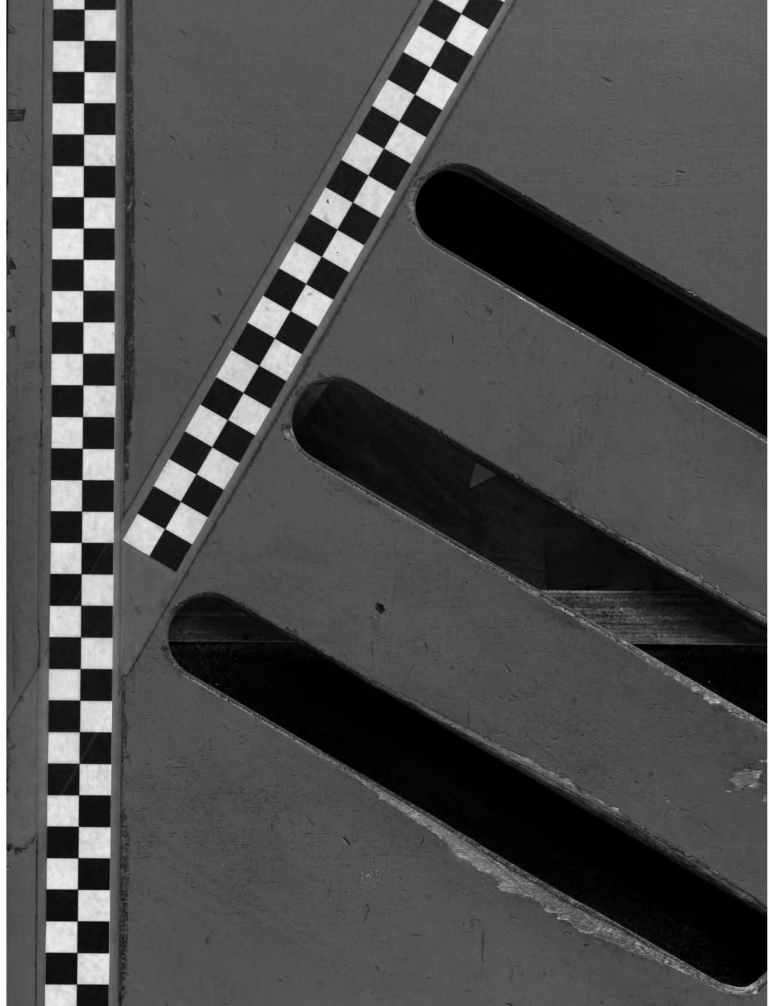
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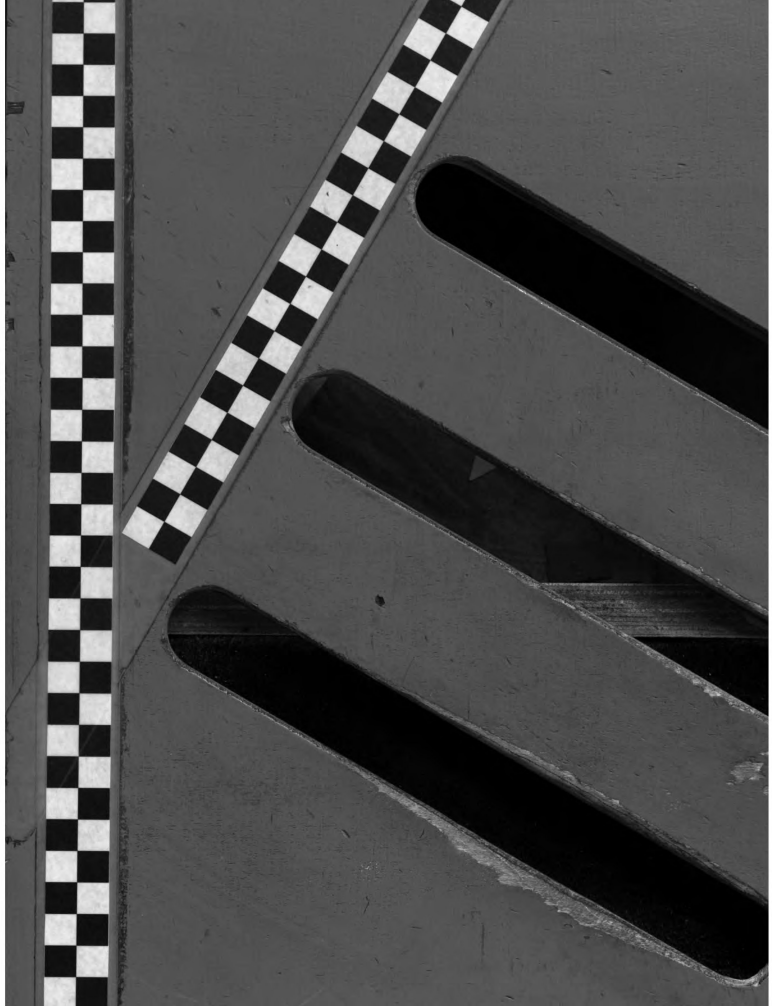
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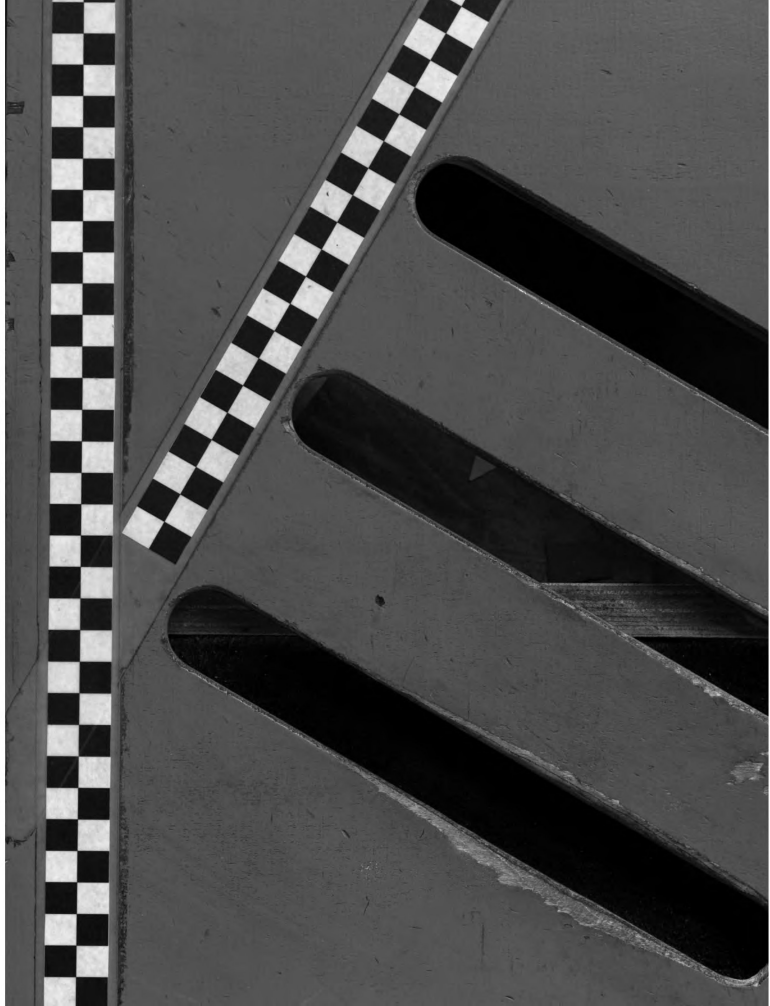
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