NSW ICAC EXHIBIT

Heavy Vehicle Programs PSC Panel
RFT Reference Number: 7.0000302935.1304

Attention: Jai Singh
Roads and Maritime Services
99 Phillip Street
Parramatta NSW 2150

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AZH CONSULTING
PTY LTD

From
AZH Consulting PTY LTD
PO BOX 235
Castle Hill NSW 1765

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J.S

AZH CONSULTING
PTY LTD

25/10/2017

Roads and Maritime Services
99 Phillip Street
Parramatta NSW 2150
Attention: *Jai Singh*

Dear Sir/Madam

Heavy Vehicle Programs PSC Panel & 17.0000302935.1304

In accordance with the terms of the above Request for Tender (RFT) we offer to provide the services the subject of this RFT. The terms of our offer are set out in our tender which is constituted by the following documents:

a) this letter;
b) a Professional Services Contract (Construction Industry) Agreement Form and all schedules, annexures and attachments referred to in it;.
c) the following addenda:
    i) *Insurances; Worker Compensation & motor vehicle*
    ii)

We acknowledge that we have received the addenda listed above and that we have taken them into account in preparing this tender. We confirm that the information provided in our tender is accurate at the date of this statement and has been provided after making all due enquiries.

Acceptance

Our tender remains open for acceptance until the end of the Tender Validity Period referred to in the Details in the RFT. We understand that RMS is not bound to accept the lowest priced tender, or any tender, it may receive.

Compliance with RFT and Code of Practice

We confirm that, having made diligent inquiries of all relevant personnel, we have complied with all applicable requirements of the RFT and the NSW Government Code of Practice for Procurement.

No Collusion

We warrant that in preparing our Tender submission that we did not communicate (verbally or otherwise) or have any arrangement or arrive at any understanding with any other tenderer which in any way reduced, or could have the effect of reducing, the competitiveness of the assessment process.

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Our confidentiality obligations

We confirm that we have complied with our confidentiality obligations in relation to this RFT.

No further revisions

In reviewing the RFT and in preparing our tender, we confirm that we have sought appropriate legal advice and guidance.

Acknowledgment

We acknowledge and agree that:

- the RFT does not create any legal relationship or obligations on RMS and we submit our tender fully understanding and accepting all of the terms of the RFT;
- RMS does not warrant or assume any responsibility for, or make any representations about, the accuracy, suitability or completeness of the RFT;
- RMS does not owe any duty of care or other responsibility to us with respect to the RFT;
- we have examined all information relevant to the risks, contingencies and other circumstances having an effect on our tender and our tender reflects those risks, contingencies and circumstances; and
- RMS will be relying upon each of the representations and warranties given by us in our tender in selecting the successful tenderer.

Yours sincerely

Signature **Zoe Hamidi, Director** as authorised signatory for **AZH Consulting PTY LTD, ABN 22615844954.**

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Schedule B1 - Executive summary

(a) An overview of your approach;

AZH has approached this tender submission on the core foundation of transparency. We sincerely believe in the high quality of our work related to this tender and we have ensured this tender submission is honest, transparent and simple to review by RMS.

(b) Factors which you consider important for RMS to consider; and

AZH believes that RMS must consider the following factors when reviewing AZH's tender submission, and any other vendor's submissions in general for the scope of this RFT:

- Demonstrated examples of previous heavy vehicle ITS field trials and scoping studies. As this is a niche industry, it takes years for a person to skill up for this relevant area of knowledge. We have provided two demonstrated scoping study examples as requested and can provide all others if requested. AZH understands that the successful tenderers must be able to hit the ground running which we are most certainly able to do as demonstrated.
- Dedication to quality of work. Also because this is a niche industry, RMS must have trust in the recommendations from any ITS consultation vendor as these recommendations are potentially used for implementation of such technologies and also need to stand up to legal questioning where required. As demonstrated in section B5 of this tender response, all our previous work in ITS field-trials/scoping studies have been accepted and praised by the customer. We have met 100% of our cost and time requirements.

(c) any other relevant information to assist RMS to better understand your tender.

No

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E manager@azhconsulting.com.au

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Schedule B2 - Company profile

(a) full name and ABN (and ACN if a company or ARBN if a foreign company);

Company Name: AZH CONSULTING PTY. LTD.
ACN Number: 615 844 954
ABN Number: 22615844954

(b) brief company history;

AZH has been operating in the ITS industry in Australia for two financial years. Following several years of international consultation with government agencies, an Australian company was established to service local customers.

(c) Overview of products and services provided by the company;

- Scoping Study Reports
- End-to-end ITS technology field-trial management
- Business Analysis / Business Intelligence and Reporting Insights
- Legislative Consultation and recommendations
- Project Management
- ITS Technology Implementation and Operations/Maintenance

(d) number of years carrying on a business providing services the subject of this RFT;

In Australia, AZH has been providing the above services for heavy vehicle ITS for over the past two financial years. This includes 7 field-trials and scoping study reports for the RMS.

(e) financial stability of the company and annual revenue over the last *12 months* of your business providing services similar to those sought in this RFT;

The company has had an annual revenue turnover of $400k in the past 12 months directly relating to providing similar services required in this RFT.

(f) the name, title, address, direct telephone and fax numbers and email address of the designated person in the company who will be RMS's primary contact during the evaluation process;

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Primary content during tender process is listed below, if you require to contact for any documentation or further questioning please contact the primary contact point.

Ali Hamidi
Operations Manager
[redacted]
manager@azhconsulting.com.au

(g) details regarding the ownership and control of your company to assist RMS to make any assessment necessary under clause 5.4; and

AZH Consulting PTY LTD is 100% owned and operated by Zoe Hamidi, who is the current director of the company

(h) any other relevant information to assist RMS to better understand your tender.

None

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Schedule B3 - Other parties
If your Tender involves other parties, you must include the following information about those other parties in this section:

This tender submission does not involve any other parties. All questions in this section B3 are hence not applicable.

~~(a) full legal name, ACN/ARBN and ABN of the company;~~

~~(b) description of the involvement of that company in your Tender;~~

~~(c) description of your relationship with that company;~~

~~(d) details of that company's track record in performing the role envisaged in your Tender; and~~

~~(e) any other relevant information to assist RMS to better understand your tender.~~

	Jai	Barry	Claire
Technical	6	4	6
Methodology	6	6	6
Past experience	9	7	8

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Schedule B5 – Non- Price Evaluation Criteria

Technical Skills (personnel)

- Qualifications and competence of proposed key personnel.

Ali Hamidi: Project management, Data analysis, Reporting/Business Intelligence, Road Transport Legislation subject matter expert, ITS Technology subject matter expert.

Zoe Hamidi: Communications Degree, Vendor/account management, contract management, finance/accounting.

- Level of technical support. Experience and responsibility level of other expert support the Project Team may draw on.

As the business manager, Zoe Hamidi draws on an extensive career in communications (Bachelor's degree in communications) and vender/account management, contract management and end-to-end business management including finance/accounting.

As the technical lead, Ali Hamidi draws on 10-year career in the technology industry, including the ITS industry, as well as an extensive IT project management and data analysis/reporting career working for a major Australian telecommunications companies. Detailed knowledge of world-wide best practises in the ITS industry drawn on from international ITS consulting for road government agencies throughout the world has enabled AZH to be an industry leader in ITS consultation and especially providing governments advice regarding best methods to go from potential ITS solutions to actual implementation while meeting all legislative requirements.

Methodology

- Understanding of project and client needs and proposed procedures to achieve project outcomes.

AZH has developed into an ITS industry leader based on a core foundational practise of understanding before action. Our company motto of "driving innovation through education" succinctly summarises that we strive to educate ourselves and our customers regarding any consultancy projects before proceeding. We believe that at least 60% of the time spent on a project should consist of planning; the other 40% is the implementation/reporting etc. This ensures all known and initially unknown customer requirements are conveyed and documented before commencing a project.

Additionally, we understand the majority of our customers do not possess a detailed understanding of the ITS industry; they generally only have a high level idea of what they technology could achieve. For this reason, we also understand that the

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planning/consultation phase should be a two-way process, in that we endeavour to adapt our customer's requirements through reverse engineering their business requirements which are not always defined or documented. All these requirements are gathered via face-to-face meetings, teleconferences, road-side meetings, ITS manufacturer meetings etc. Essentially, we manage any ITS field-trials/consultation/scoping-study end-to-end by determining the following:

1. Legislative guidelines and requirements of the ITS technology in question;
    a. Ie/ what transport/road law can the ITS technology be used for detection and/or data collection and/or infringement.
2. ITS technology Gazettal Requirements for the relevant regulatory program(s);
    a. Ie/ does the ITS technology require gazettal for the relevant ITS technology.
3. ITS Field Trial requirements;
    a. Ie/ what does the ITS technology require (communications, trigger systems, custom in-road housings etc) to enable accurate data to be collected for the field-trial.
4. Scoping Study report detail
    a. Ie/ what amount of detail does the customer require in the scoping study report to achieve the outcome. This is further discussed in the next two sections of the tender response.

- Method of programming and identification of key elements and resources required and available.

We run all ITS consultation projects and field trials/scoping studies in the following methodology:

1) Consultation (as described in the previous question)
2) Customer/business requirements documentation
3) Upon confirmation from the customer that the ITS business requirements are accurate, we proceed to the scheduling/ project-management stage. This stage ensures cost and time KPI's are met and the business outcomes required by the customer are met.
4) Managing ITS trials with the customer and end-users (usually enforcement officers in their respective jurisdiction). It is critical to involve the end-users to ensure their business requirements are met with the ITS technology being trialled/consulted upon.
5) Scheduling ITS trials on the road side or other specified location. This involves planning with state authorities (such as RMS), local councils, and human resources (enforcement officers, police officers etc).
6) Running ITS field-trials on the road side or other specified location for a specified length of time to gather the required amount of data to test the proof of concept of the ITS technology being trialled.

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7) Once the required amount of data has been gathered during the field-trial, we move to the reporting and analysis phase. This phase is the most complex as we ensure we translate technical data into layman terms for our customers to be able to make an informed decision regarding this ITS technology and potential implementations which meet legislative requirements moving forward. The following is an adaptable high-level layout we use to document our scoping studies:
    a. Purpose.
    b. Background (documents the business problem that the ITS technology aims to resolve).
    c. ITS technology and Theory.
    d. Method of testing.
    e. Results.
    f. Conclusion.
    g. Proposal/Recommendations for implementation of this ITS technology while meeting legislative guidelines/requirements.
    h. Appendix containing all related data etc.

8) Submission of draft document to customer for review. Several meetings are now held to explain the contents of the scoping study to the customer. Particular attention is paid to translating the technical information into understandable and implementable solutions for the customer. Generally, the customer uses this opportunity to educate themselves, and their organisation on the potential business and road-safety benefits of implementing the ITS technology.
9) Reviews and final submission of scoping study documents, data-sets etc.
10) Final Meetings held with end-users and customer to update on the conclusion of the ITS trial and provide any further assistance.

Innovation/creative quality of proposal.

Following on from the above response for "methodology", we spend a large portion of the planning phase understanding what format the customer would like the proposal and reports in. All customers are different and we appreciate the fact that if the customer cannot understand what we have provided, then we have not performed our role adequately. For this reason, we innovate and adapt our proposals, ITS field-trials and scoping study reports according to the customer's understanding of the ITS technology in question and the outcome they seek, as well as taking into account the most efficient way that the ITS technology can be trialled.

For example, one field trial we performed for RMS (Houston Radar over-length vehicle detection system) required to be mounted at Galston Gorge which was a high-risk road for pedestrians/humans to attend. AZH proposed a safe and lower cost option for RMS to achieve the same outcomes without any human needing to

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physically attend site for the field-trial. We added mobile communications and CCTV functionality in the Houston Radar technology to enable us to run the field-trial remotely and providing a safer option and lower cost to RMS.

A customer with little understanding generally requires more innovative ideas and implementation options. A customer with a detailed understanding of the applications of the ITS technology generally needs very little creative/innovative options and generally require more documentation surrounding legislative requirements and especially risks of using the ITS technology etc which AZH has developed into an industry leader.

Past Performance/Demonstrated Experience with heavy vehicle ITS regulatory technology trials (Time, Cost, Quality)

- Record of performance on similar projects including standard of outputs: Provide a list of all heavy vehicle ITS regulatory technology trials performed during the past two years AND attach at least two detailed reports produced for these trials

Below is a list of HV ITS field trials and scoping study reports AZH has performed in the past 2 years:

HV ITS Trial	Regulatory Function	Completion on time including meeting milestones and deadlines.	Completion within agreed budget.	Achievement of quality aspects.
FLIR Thermal Trial at Picton Rd	Defective brake detection.	Yes	Yes	Yes- accepted by client
SICK high-speed dimension scanner at Marulan HVSS	Over-dimension vehicles	Yes	Yes	Yes- accepted by client
TIRTL/Optris Thermal sensor at Mt Ousley Rd	Defective brake detection.	Yes	Yes	Yes- accepted by client
TIRTL/LTI dimension scanner at Marulan HVSS	Over-dimension vehicles	Yes	Yes	Yes- accepted by client
Houston radar trial at Galston Gorge	Over Length heavy vehicles	Yes	Yes	Yes- accepted by client
PAT Dynamic portable scale trial at Sydney on-road site	Low-cost and low-time over-mass vehicle detection.	Yes	Yes	Yes- accepted by client
HAENNI Dynamic portable scale trial at Lismore on-road site	Low-cost and low-time over-mass vehicle detection.	Yes	Yes	Yes- accepted by client

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As requested, attached are two examples of a scoping study produced following end-to-end field-trial management of ITS technology.

- We have provided one scoping study which the customer required extensive and a high-level detail and high level of innovative/creative reporting due to their minimal understanding of the technology, implementation and suitable applications; this is the *"FLIR Thermal Camera: Field Trial and Scoping Study"* document attached.
- Also attached is an example of a much less detailed scoping study as the customer had an extensive understanding of the ITS technology, implementation and application; this is the *"SICK Free Flow Vehicle Profiling System Scoping Study"*. This shows our adaptability to the customer to deliver the outcomes sought.

- Completion on time including meeting milestones and deadlines.

Commented in the table. Met all milestones and deadlines for all projects.

- Completion within agreed budget.

Commented in the table. Met all budgets for all projects.

- Achievement of quality aspects.

Commented in the table. Met all quality aspects for all ITS field trials and scoping study reports. All scoping study reports have been accepted by the client.

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Schedule B6 - References

(a) name of the organisation;

Roads and Maritime Services

(b) Name, title, address and telephone number of the person we can contact;

Name: Jai Singh

Address: 110 George street Parramatta

Phone: 0405334088

(c) Services provided;

- ITS field trial end-to-end management
- ITS scoping study reports
- ITS legislative consultation and recommendations for road safety

(d) Organisation's industry;

Consultation services, Project Management Services

(e) scale of operations in terms of quantity of services, dollar value and any other relevant factors; and

- Quantity: AZH has been providing field-trial, consultation/scoping study report services for heavy vehicle ITS for over the past two financial years. This includes 7 field-trials and scoping study reports for the RMS.

- Dollar Value: The cost of each project depends solely on the requirements and scope of the customer which translates into a certain amount of time and resources estimated to be spent on each project. We provide value for money and attempt where possible to provide fixed price proposals to enable our customers to simplify their financial accounting processes.

(f) any other relevant information to assist RMS to better understand your tender.

AZH is happy to provide any additional information to assist RMS in the tender review.

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Please note the following attachments

- **Attachment C** – Under the tender specifications this document is not required, therefore has not been included in this tender submission.
- **Attachment D** - Under the tender specifications this document is not required, therefore has not been included in this tender submission.
- **Attachment E** – Not Applicable, AZH Consulting PTY LTD have not employed any companies/persons to submit a response on their behalf.
- **Attachment F** - Under the tender specifications this document is not required at submission, therefore has not been included in this tender submission.
- **Workers Compensation Insurance** documentation has been attached with this submission; please refer to the document enclosed.
- **Motor Vehicle Insurance documentation** has been attached with this submission; please refer to the document enclosed.

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AZH CONSULTING
PTY LTD

FLIR Thermal Camera: Field Trial and Scoping Study

for Roads & Maritime Services heavy vehicle brake and tyre defect detection.

15th March 2017.

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1. Purpose

This report details the trial conducted for the Roads & Maritime Services (RMS), which tested the efficacy of thermal imaging technology for assessing potential defects on heavy vehicles. The trial was conducted over during the month of February 2017, at the Picton Road heavy vehicle inspection station near Wilton NSW 2571.

Currently the inspection of vehicles is on a randomised basis. Each vehicle inspection takes around thirty minutes and the number of vehicles inspected is a very small percentage of the total vehicles travelling on the road. Over the two full days of trials, fourteen trucks were inspected by the team.

An automated thermal inspection system will allow trucks with potential defects to be identified for manual inspection. This would allow the inspectors' time to be used more effectively, by allowing targeted rather than random inspections to take place.

The methods used and the results of the trial are summarised within this report, along with a summary of how the technology can be applied for automated inspection.

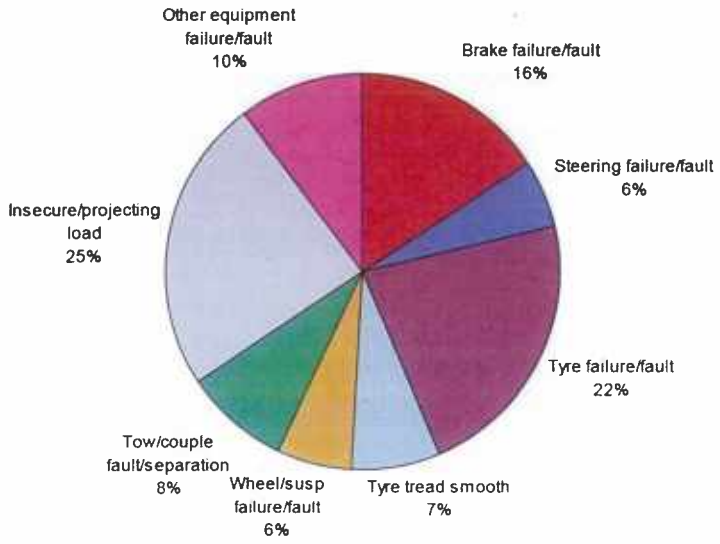
2. Background

During the 12 months to the end of June 2016, 208 people died from 182 fatal crashes involving heavy trucks or buses. These included:

- 111 deaths from 96 crashes involving articulated trucks
- 79 deaths from 68 crashes involving heavy rigid trucks
- 25 deaths from 22 crashes involving buses.

Statistics published January 2014 show that one in seven (15%) single heavy vehicle crashes had an equipment failure reported for that truck. Of these faults, brake failure made up 16%, tyre failure made up 22% and wheel/suspension failure made up 6% of documented incidents. Thermal imaging has the potential to detect these types of faults, which equate to 44% of total equipment related failures.

Heavy Trucks in Single Vehicle Crashes with Equipment Factor, 2010 to 2012,Type of Vehicle Equipment Factor



Source http://roadsafety.transport.nsw.gov.au/downloads/heavy-truck-crash-data0114.pdf

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3. Technology and Theory

Thermal imaging cameras, such as the FLIR A615, detect and display differences in temperatures by detecting the intensity of thermal radiation. The FLIR A615 thermal imaging camera can accurately measure the temperature of more than 300,000 separate points, simultaneously. The raw sensor data from the camera is sent to an industrial processor, over Ethernet connection, where the processor assesses and analyses the images, in real-time.

Preliminary investigations have determined that conditions such as malfunctioning brakes, overheated bearings and other tire risks, can be detected by thermal anomalies that are identifiable by the thermal imaging camera. For example, defective or non-functioning brakes are typically colder than a vehicle's operational brakes. This difference is clearly visible on a thermal image.

4. Method

During the trial, the camera was mounted in the centre of the road as shown below. The camera used was a Flir A655sc with 45° horizontal field of view lens. Thermal footage was captured over two days with a variety of different truck types. Anomalies detected by the system were flagged with the RMS inspection staff for further investigation.

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Tests were also performed to determine the ability of the FLIR line of cameras to capture fast moving vehicles. Cameras were set up as shown below for a view of trucks travelling more than 80km/h.

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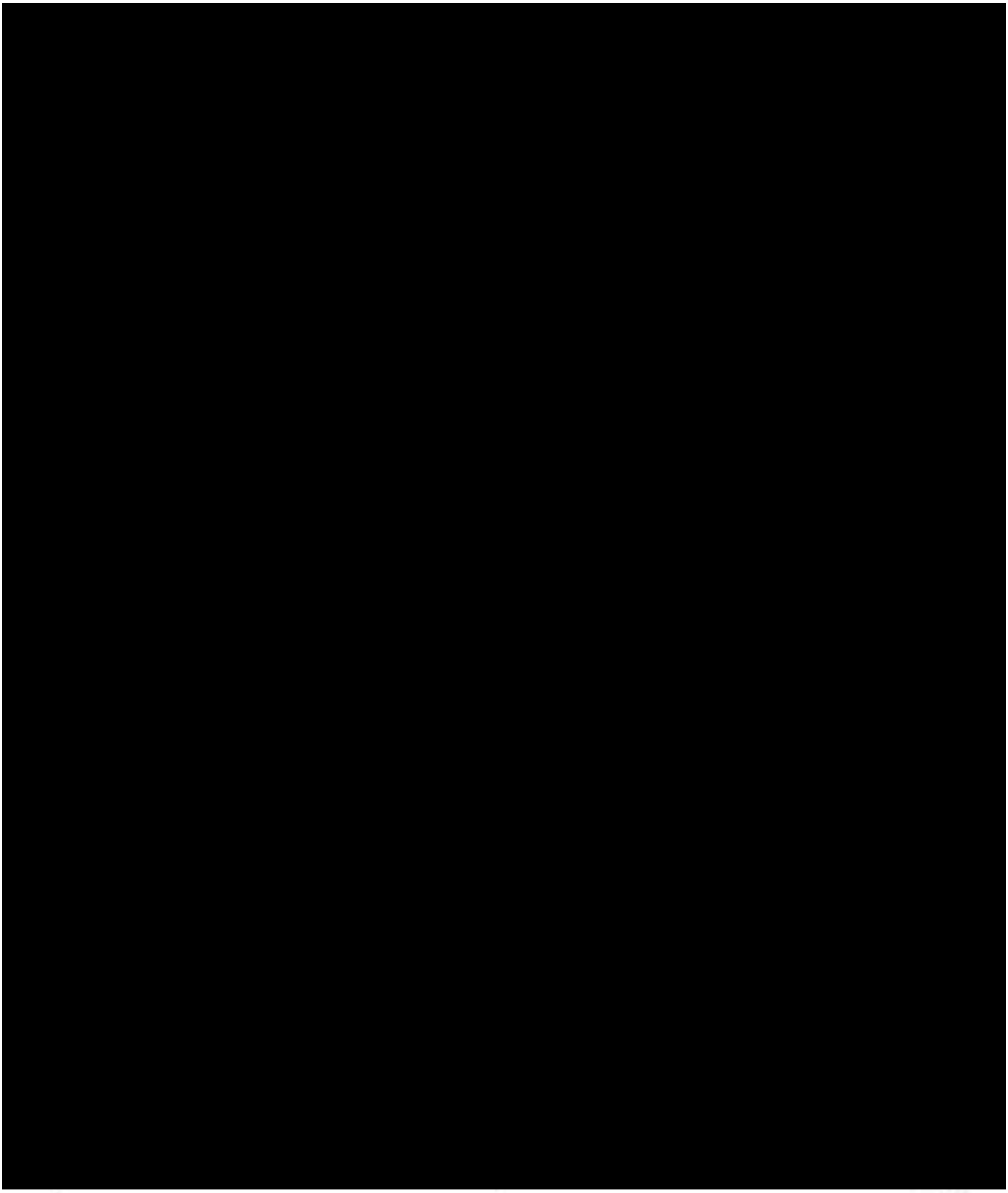

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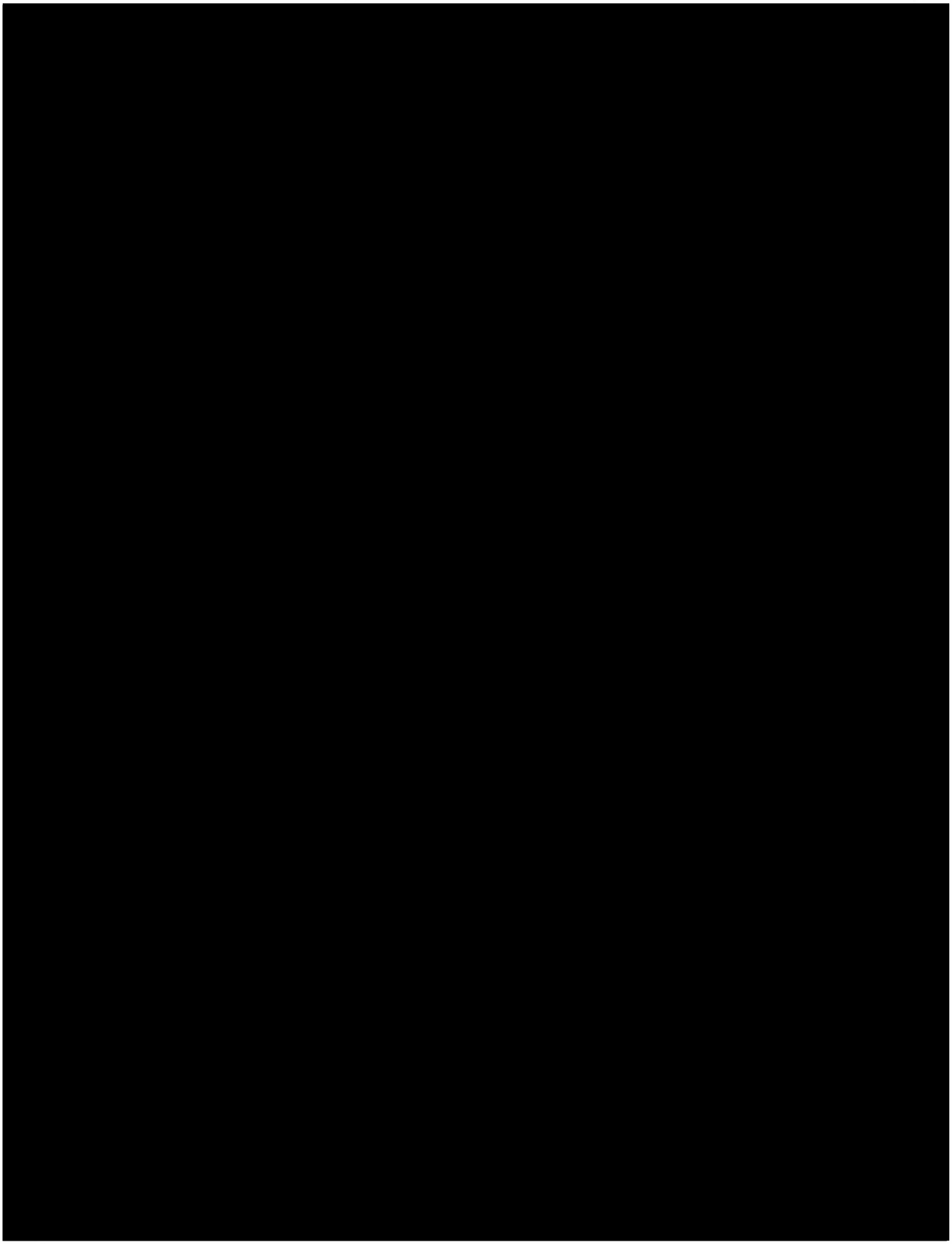

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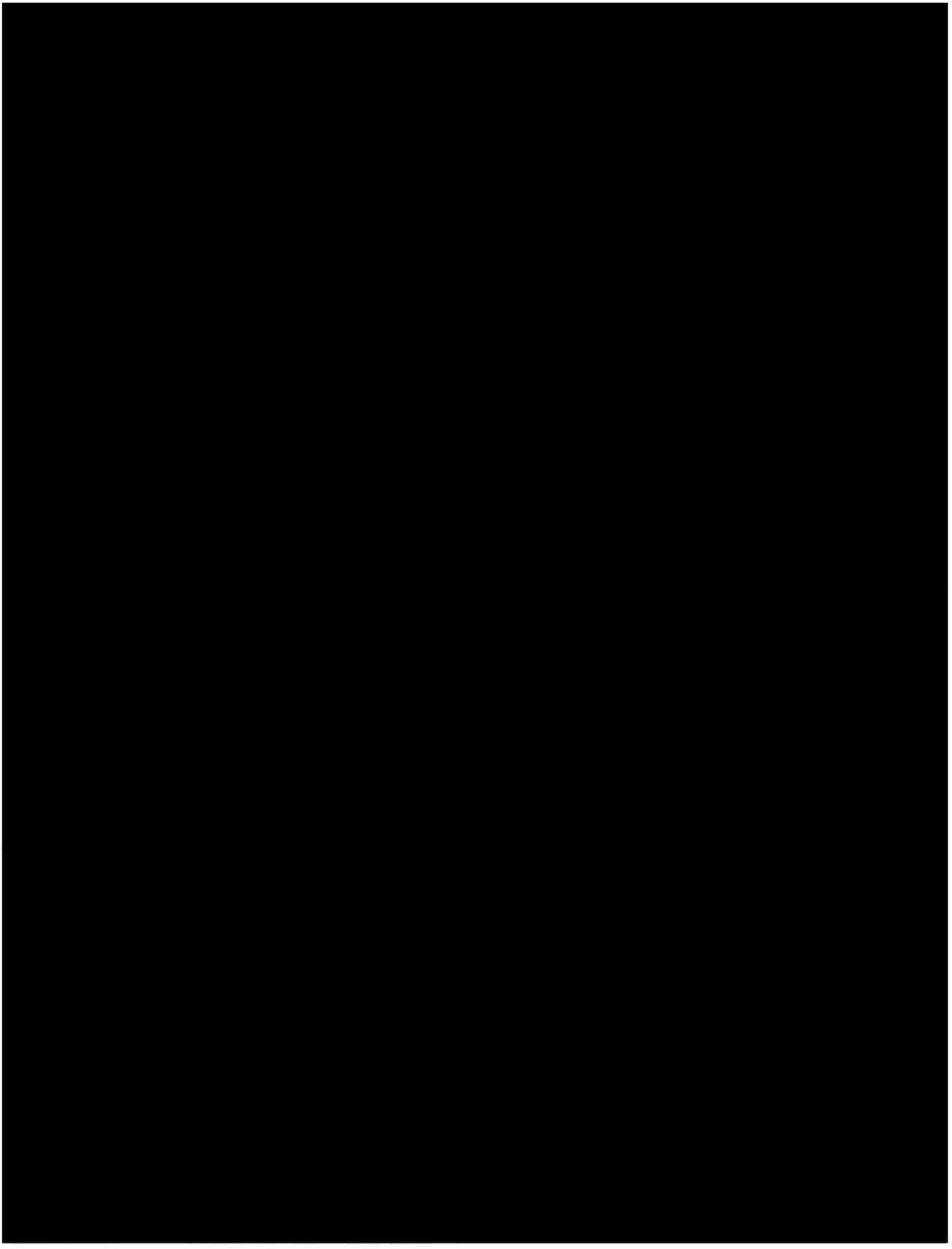

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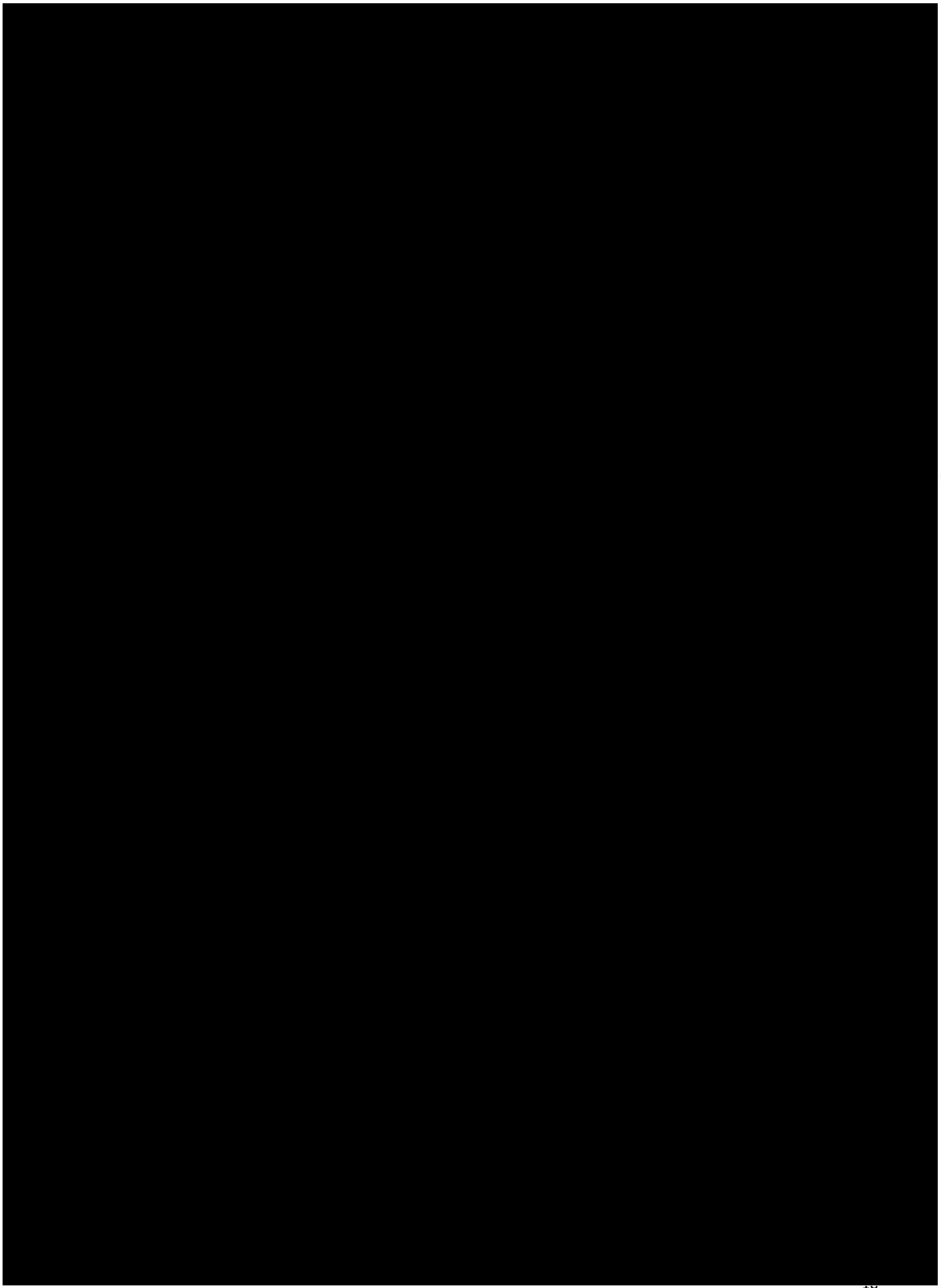

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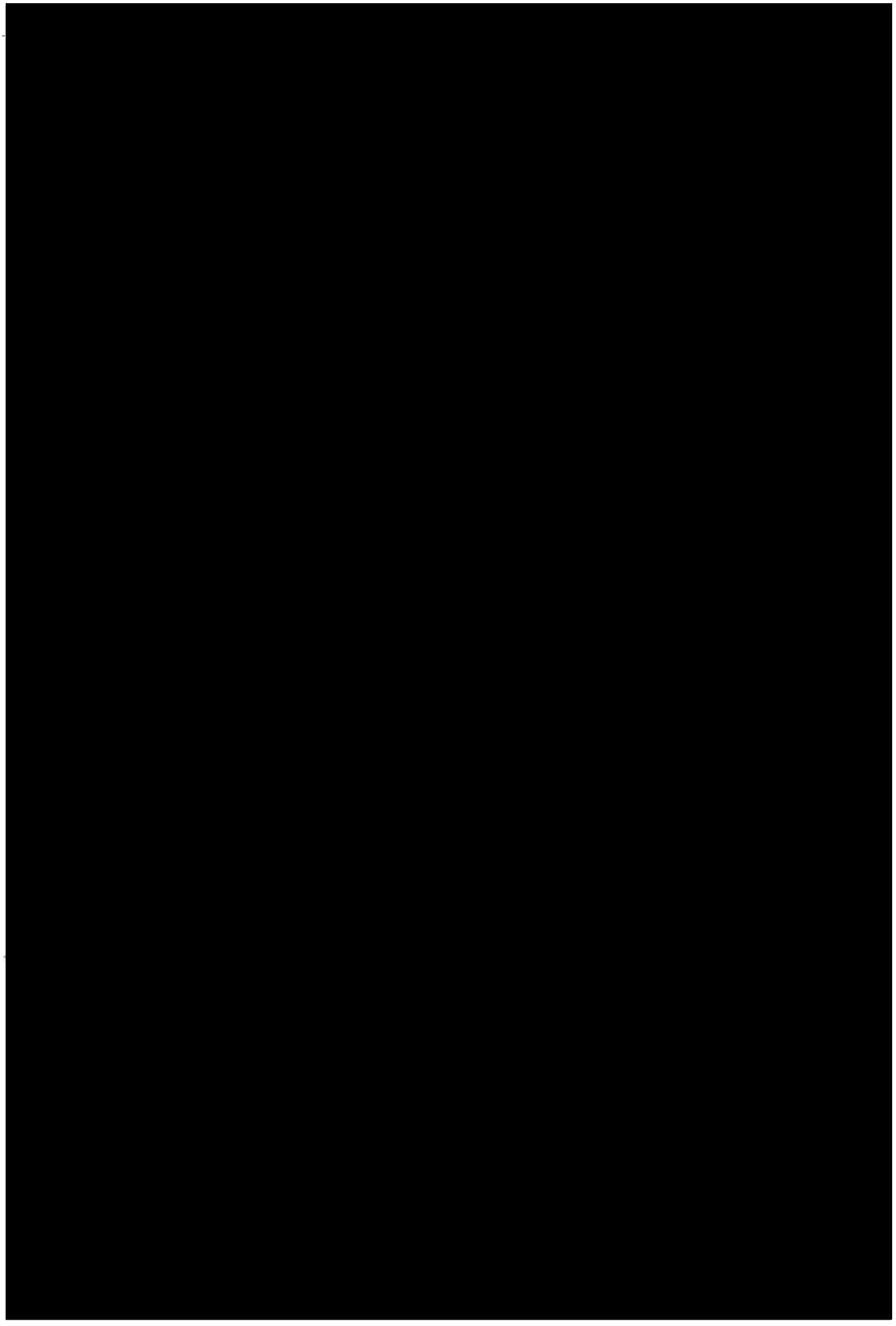

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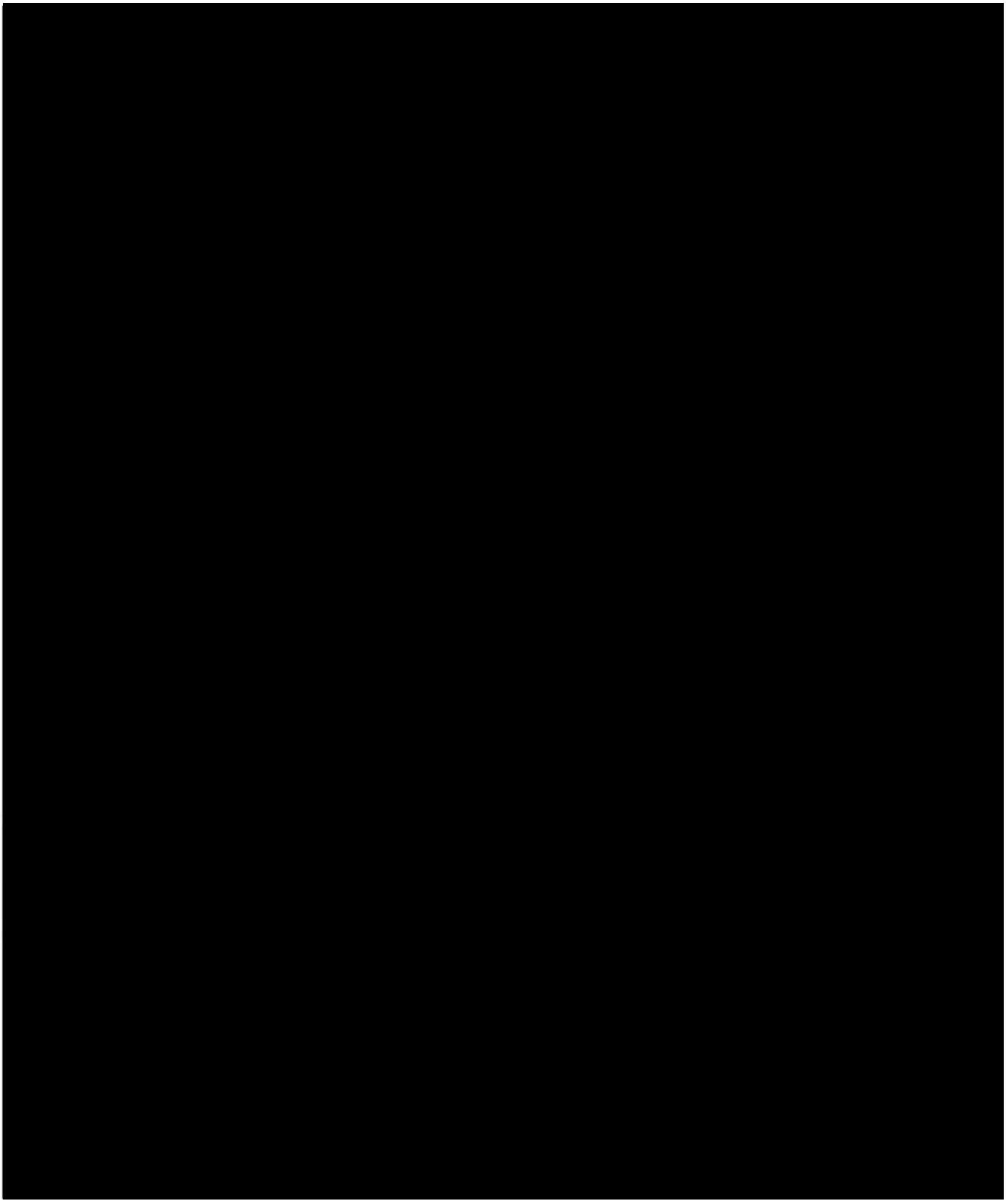

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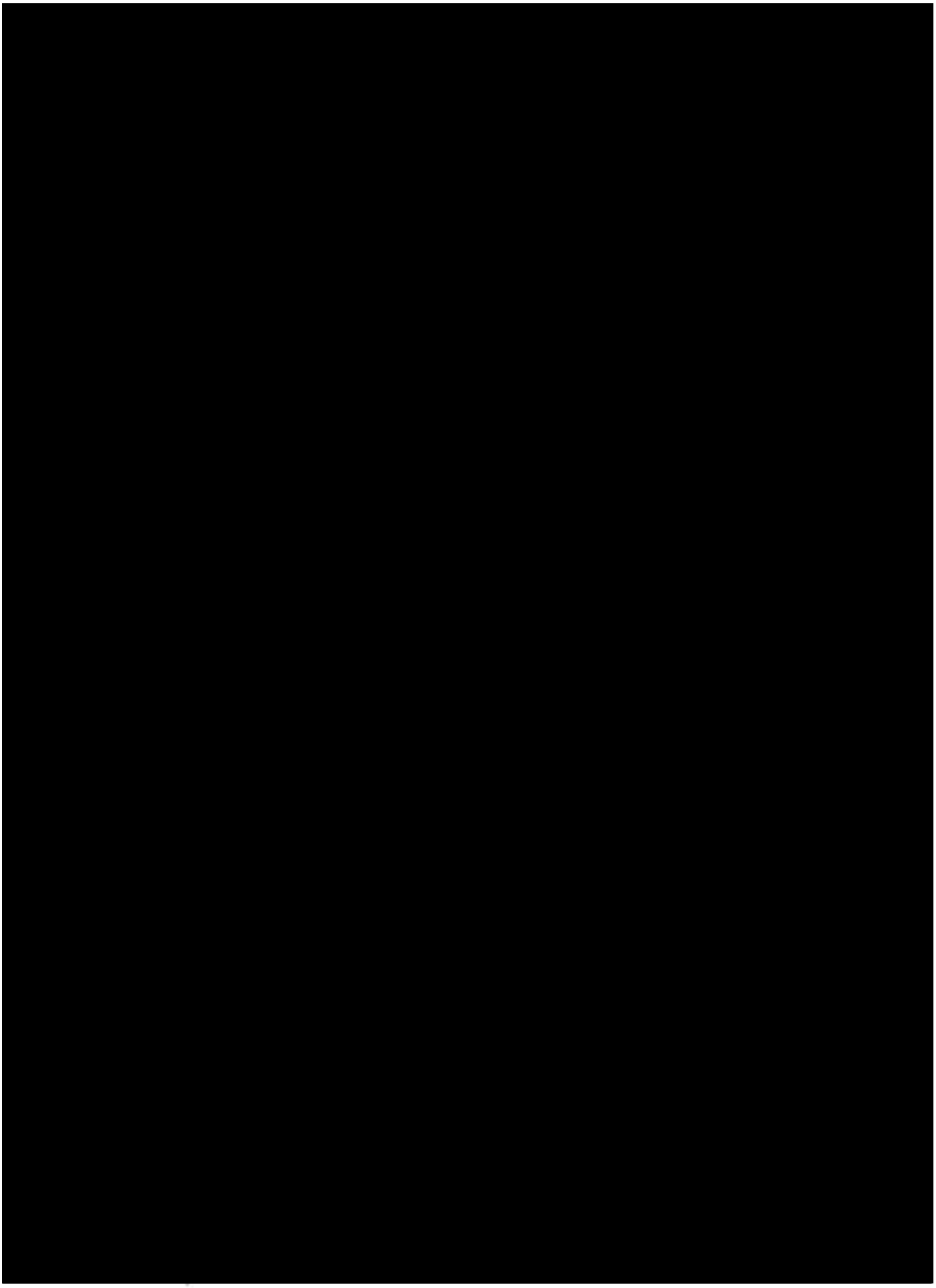

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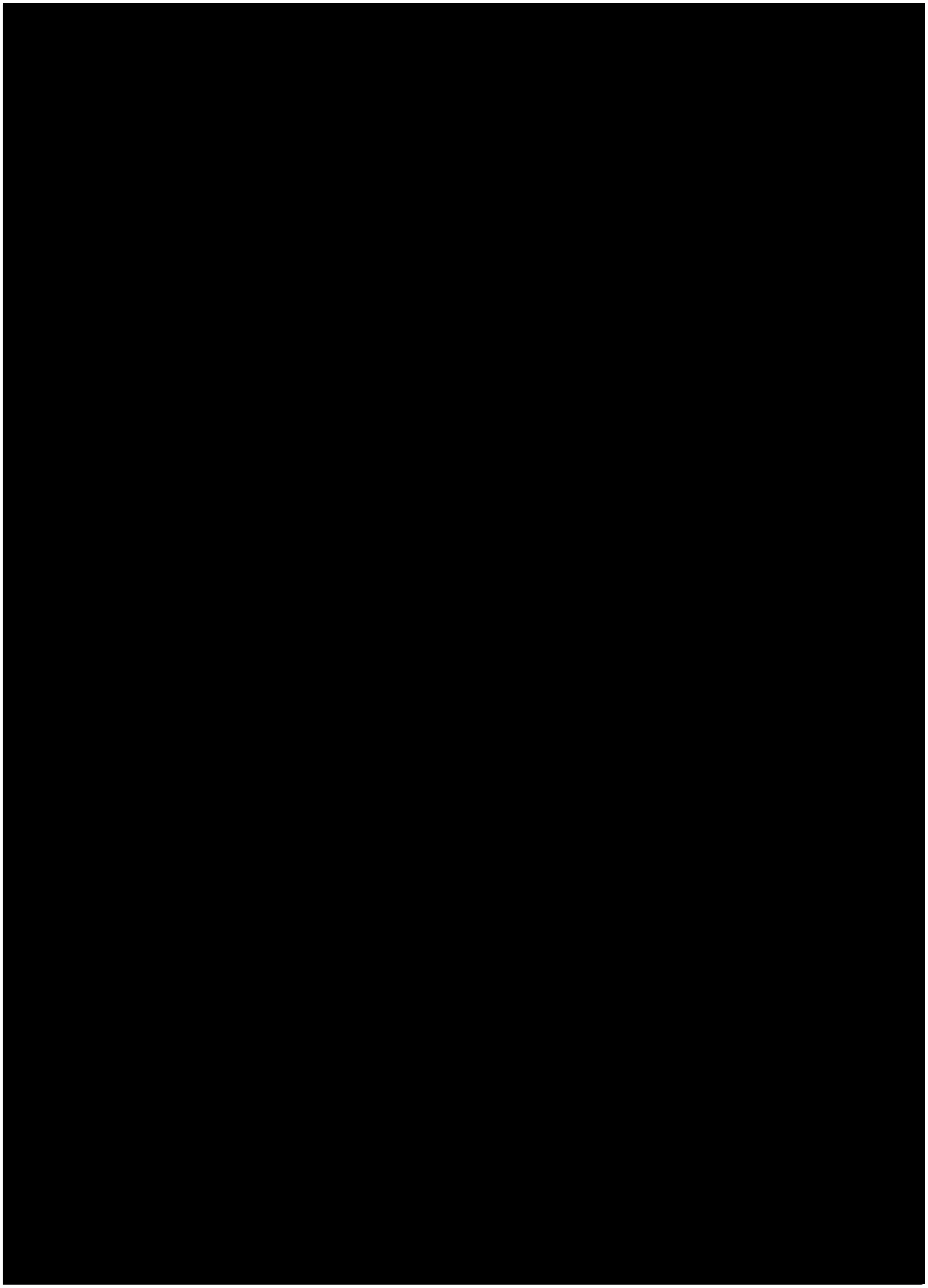

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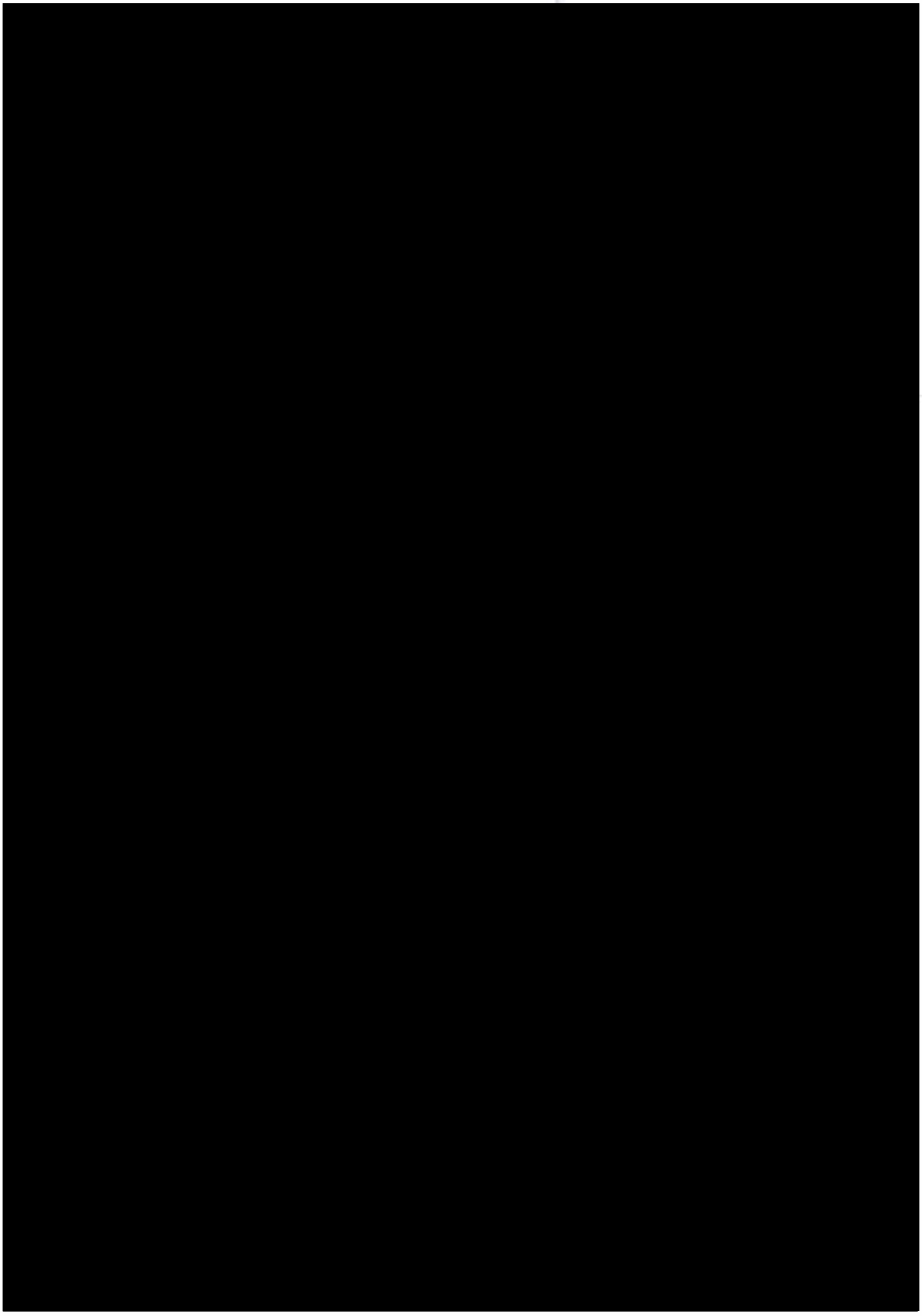

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AZH CONSULTING
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SICK Free Flow Vehicle Profiling System

Scoping Study

for Roads & Maritime Services heavy vehicle over-dimension screening.

1st May 2017.

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Contents

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1.0 Introduction

A SICK Free Flow Vehicle Profiling System (FPS) has been installed at the RMS Heavy Vehicle Checking Station – 12 Mile Creek(Pacific highway South-Bound) in the screening lane.

The intent of this Proof of Concept (POC) trial was for Road Maritime Services (RMS) to install a FPS for pre-screening of all heavy vehicles with Gross Vehicle Mass (GVM) greater than eight tonne and compare the dimensional values to manual measurements using conventional techniques. The purpose of the installation is to prove the FPS's accuracy and ensure the suitability of the system for heavy vehicle dimensional measurement at high speeds.

This will enable RMS to automatically screen heavy vehicles which are over dimension (height, width, length). The result being that RMS can intercept heavy vehicles which are over-dimension, and conversely, not intercept vehicles which are compliant so as not to interrupt freight transport.

2.0 Overview of work

Three scanners and one computer were installed and commissioned on a gantry above the screening lane at 12 Mile Creek inspection station

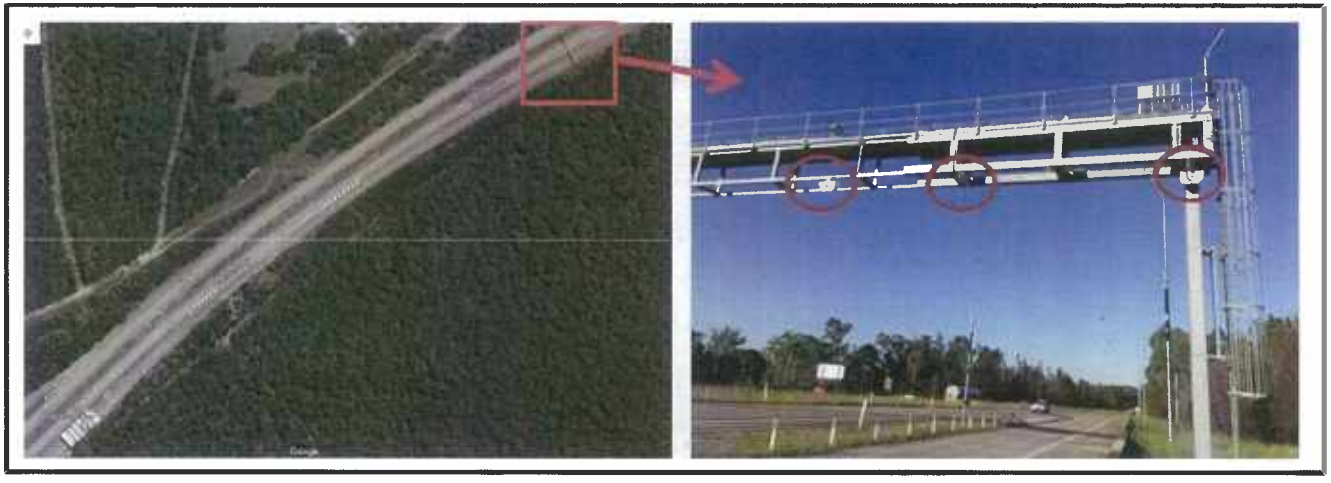

Figure 2.0.1

A total of 53 Vehicles were compared.

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3.0 Recorder Data (overview)

Vehicle	FPS Data				RMS Manual Measure			Comparison			
Number	Length	Width*	Height	km/h	Length	Width	Height	Length	Width	Height	Comment
001	16.63	3.02	3.62	65	16.68	0	3.794	0.05	-3.02	0.174	HEIGHT - Difficult to measure manually WIDTH - Noise Point
002	8.54	2.32	2.39	69.7	8.45	2.33	2.37	-0.09	0.01	-0.02	HEIGHT - Missed Stack (measured tailor
003	19.41	2.72	3.96	36.2	19.48	0	4.01	0.07	-2.72	0.05	WIDTH - Hard to manual measure
004	18.86	2.63	3.99	59.8	19.03	2.55	4.014	0.17	-0.08	0.024	WIDTH - Hard to manual measure
005	18.91	2.62	3.54	40.1	18.9	2.68	3.57	-0.01	0.06	0.03	
006	18.08	2.71	4.5	54.7	17.84	2.7	4.59	-0.24	-0.01	0.09	HEIGHT - Manual measure hard to get as cannot touch loaded cars
007	17.39	2.64	4.21	56.6	17.1	2.6	4.28	-0.29	-0.04	0.07	HEIGHT - only 1 data point on stack (may have missed highest point)
008	17.32	2.68	3.86	52.5	17.45	2.59	3.98	0.13	-0.09	0.12	HEIGHT - only 1 data point on stack (may have missed highest point) WIDTH - Can't measure the outer points with tape
009	7.7	2.72	3.38	57.2	7.76	2.58	3.372	0.06	-0.14	-0.008	WIDTH - Truck Curtain bulging when driving
010	10.48	2.63	3.32	46	10.5	2.5	3.32	0.02	-0.13	0	

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011	14.67	2.61	3.48	56.1	14.9	2.54	3.5	0.23	-0.07	0.02	
012	21.73	2.66	4.24	40.7	21.44	2.66	4.26	-0.29	0	0.02	LENGTH - Vehicle may be longer when driving?
013	19.44	2.62	3.67	54.2	19.37	2.6	3.64	-0.07	-0.02	-0.03	
014	10.61	2.6	4.2	54.1	10.67	2.5	4.22	0.06	-0.1	0.02	
015	19.83	2.68	4.3	51.9	19.75	2.63	4.323	-0.08	-0.05	0.023	WIDTH - cannot measure width manual
016	18.97	2.67	3.88	59.4	18.9	2.62	3.906	-0.07	-0.05	0.026	
017	17.73	2.64	4.29	53.1	17.66	2.51	4.28	-0.07	-0.13	-0.01	WIDTH - Could not measure manually
018	20.19	2.61	3.26	52.2	20.75	2.52	3.265	0.56	-0.09	0.005	Length - Unknown issue with length (possibly missed end of vehicle)
019	11.23	2.61	3.85	51.8	11.27	2.55	3.91	0.04	-0.06	0.06	

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Vehicle Number	FPS Data Length	FPS Data Width *	FPS Data Height	km/h	RMS Manual Measure Length	RMS Manual Measure Width	RMS Manual Measure Height	Comparison Length	Comparison Width	Comparison Height	Comment
020	18.74	3.01	4.43	45	18.93	2.6	4.29	0.19	-0.41	-0.14	HEIGHT - Cannot manually measure WIDTH - Noise
021	18.99	2.63	3.66	51.8	18.27	2.51	3.838	-0.72	-0.12	0.178	HEIGHT - FPS Missed stack Length - Noise at front of vehicle
022	23.76	2.63	4.37	54.8	23.535	2.59	4.356	-0.225	-0.04	-0.014	
023	22.11	2.74	3.94	75.3	22.36	2.72	3.987	0.25	-0.02	0.047	
024	8.94	2.61	3.39	27.7	8.805	2.59	3.405	-0.135	-0.02	0.015	
025	19.37	2.63	4.02	52.9	19.25	2.6	4.048	-0.12	-0.03	0.028	
026	25.73	2.66	4.34	62.3	25.66	2.505	4.309	-0.07	-0.155	-0.031	WIDTH: Manual measure at back of trailer
027	25.82	2.64	4.15	53.2		2.56	4.135	-25.82	-0.08	-0.015	LENGTH: could not measure as truck not parked straight in bay
028	8.84	2.59	2.87	53.5	8.86	2.49	3.162	0.02	-0.1	0.292	HEIGHT: Missed Stack
029	25.55	2.67	4.39	47.9	25.5	2.52	4.385	-0.05	-0.15	-0.005	WIDTH: VPS picked up budge in curtain
030	17.42	2.61	4.22	51.3	17.53	2.57	4.222	0.11	-0.04	0.002	
031	20.17	2.66	4.17	53.5	19.85	2.55	4.141	-0.32	-0.11	-0.029	LENGTH - Difficult to measure manually
032	14.52	2.61	3.47	61.6	14.8	2.53	3.49	0.28	-0.08	0.02	
033	24.88	2.65	4.24	60.5	25.04	2.46	4.28	0.16	-0.19	0.04	
034	17.33	2.57	3.01	56.9	17.14	2.48	2.926	-0.19	-0.09	-0.084	HEIGHT - Missed thin protrusion (about 40mm thickness)

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035	18.35	2.66	3.93	54.9	18.34	2.57	3.923	-0.01	-0.09	-0.007	WIDTH - Budging curtain, could not measure
036	14.8	2.59	3.92	56.8	14.94	2.54	3.93	0.14	-0.05	0.01	Comment: Very shiny Vehicle (milk truck)
037	14.32	2.69	3.59	53.3	14.17	2.64	3.65	-0.15	-0.05	0.06	HEIGHT: Used Stack however tarp was higher point (couple not measure manually)
038	16.22	2.62	3.84	49.6	16.04	2.54	3.845	-0.18	-0.08	0.005	
039	26.26	2.64	4.5	61.4	25.98	2.59	4.6	-0.28	-0.05	0.1	HEIGHT: FPS Missed the Peak of the height measurement
040	25.56	3.05	4.26	49.6	25.71		4.237	0.15	-3.05	-0.023	WIDTH: Noise on measurement
041	19.67	2.64	4.05	42.3	19.6	2.6	4.052	-0.07	-0.04	0.002	

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Vehicle	FPS Data				RMS Manual Measure			Comparison			Comment
Number	Length	Width*	Height	km/h	Length	Width	Height	Length	Width	Height	
042	16.91	2.61	4.04	58.4	16.98	2.505	4.097	0.07	-0.105	0.057	HEIGHT: Did not capture full Stack
043	26.14	2.66	4.47	56.8	25.9	2.55	4.645	-0.24	-0.11	0.175	HEIGHT: Point cloud missing Top Points
Changed Config - BoxLengthMaxY = 6000 (was 4500)											
044	6.11	2.06	2.2	37.3	6.2	1.98	2.269	0.09	-0.08	0.069	
045	19.09	2.62	3.28	55.5	19.2	2.52	3.293	0.11	-0.1	0.013	
046	15.81	2.6	4.08	59.5	17.86	2.53	4.074	2.05	-0.07	-0.006	LENGTH: Possible issue with speed measurement on FPS
047	25.52	2.61	3.87	51.2	24.12	2.55	4.31	-1.4	-0.06	0.44	HEIGHT: FPS Missed Stack LENGTH: Possible issue with speed measurement on FPS
048	21.49	3.19	4.22	54.6	20.8	3.15	4.225	-0.69	-0.04	0.005	LENGTH: May have influence from Flags (Driver Confirmed 20.8 is correct)
049	10.34	2.57	3.66	53.6	10.4	2.51	3.71	0.06	-0.06	0.05	
050	7.31	2.43	2.59	52.3	7.11	2.35	2.64	-0.2	-0.08	0.05	
051	8.24	2.61	3.14	53.1	8.3	2.54	3.134	0.06	-0.07	-0.006	
052	17.15	2.73	3.69	44.1	17.2	2.6	3.729	0.05	-0.13	0.039	Width Could not manual measure
053	10.23	2.57	2.68	46.8	9.9	2.46	2.68	-0.33	-0.11	0	

Table 3.0.1

* FPS Width measurement ignores the first 2.6m of the vehicle to attempt to exclude vehicle mirrors

NSW ICAC EXHIBIT

4.0 Comparison

Some data has been excluded from the analysis. Data has been excluded if there was an issue with the manual measurement (such as RMS inspectors did not measure outer most point) or if there was an issue with the FPS measurement (such as "noise" being created on highly shiny surfaces)

Length Average Variance[3, 6] = -0.1% (0.013m) with an average speed of 53.2 km/h over 45 vehicles

Width Average Variance[4, 6] = -2.57% (0.064m) with an average speed of 53.3 km/h over 40 vehicles

Height Average Variance[5, 6] = +0.38% (0.012m) with an average speed of 51.9 km/h over 39 vehicles

Expected FPS Performance:

Description	Typical measurement accuracy (95% of vehicles)	Comment
Length [1]	±1.000 mm (σ=500mm)	Speed < 80 km/h
Width [2]	±100 mm (σ=50mm)	Speed < 80 km/h
Height [2]	±30 mm (σ=15mm)	Speed < 80 km/h

Table 4.0.1

[1] Project separated vehicles with a minimum gap of 2.0m.
[2] For width and height measurement, the object cross section must be > 100mm and a remission of >2% (= antennas might not be detected). For width / height measurement the scanner frequency is 75 Hz.
[3] Length Variance formula = (Manual Length – FPS Length) / Manual Length [4] Width Variance formula = (Manual Width – FPS Width) / Manual Width
[5] Height Variance formula = (Manual Height – FPS Height) / Manual Height
[6] Figures do not include "data has been excluded from the analysis" noted in section 4.0

NSW ICAC EXHIBIT

4.1 General Observations

- Some measurements were very hard to compare due to accessibility of measurement point for manual measurement.
- The more manual measurements carried out the more accurate they became in in comparison to the FPS System.
- Manual measurements made often varied in accuracy based on the person carrying out the measurement.
- Comparison of width measurements were particularly problematic due to
    - difficulty accessing the widest points
    - manually measuring between widest points
    - spurious objects being measured by the FPS such as flags straps and small branches (on log trucks)

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4.2 Length

FPS measurement allowable error = ±1.00m
Manual measurement uncertainty = ±0.11m

Chart 4.2.1
Please note: Excluded Vehicles # are 012, 018, 021, 027, 031, 046, 047 and 048.

Image 4.2.1 (Vehicle 020)

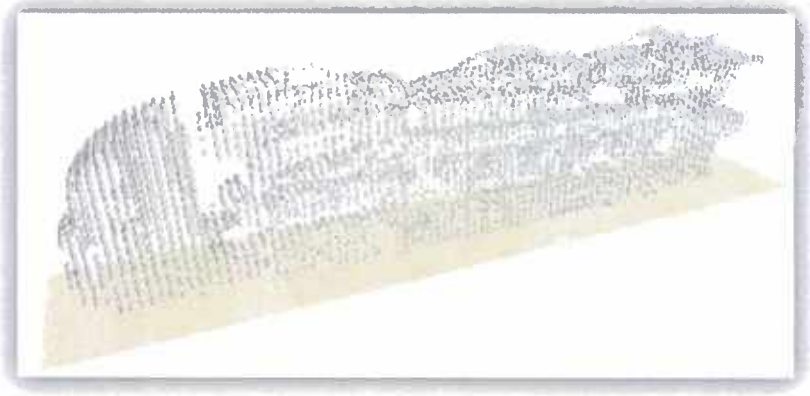

Image 4.2.2 (Vehicle 060)

4.3 Width

FPS measurement allowable error = ±0.10m
Manual measurement uncertainty = ±0.03m

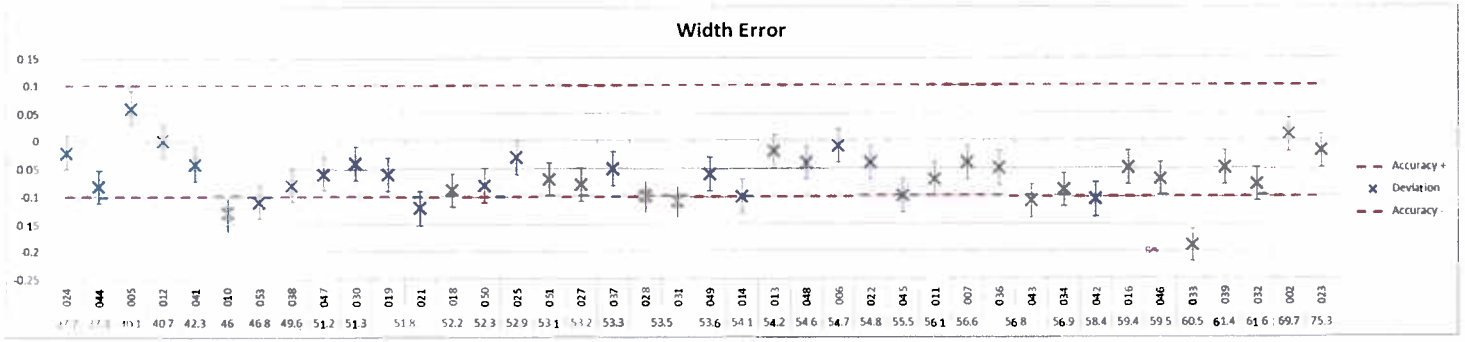

Chart 4.3.1

Please note: Excluded Vehicles # are 001, 003, 004, 008, 009, 015, 017, 020, 026, 029, 035, 040 and 052.

Image 4.3.1 (Vehicle 021)

Image 4.3.2 (Vehicle 025)

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4.4 Height

FPS measurement allowable error = ±0.03m
Manual measurement uncertainty = ±0.04m

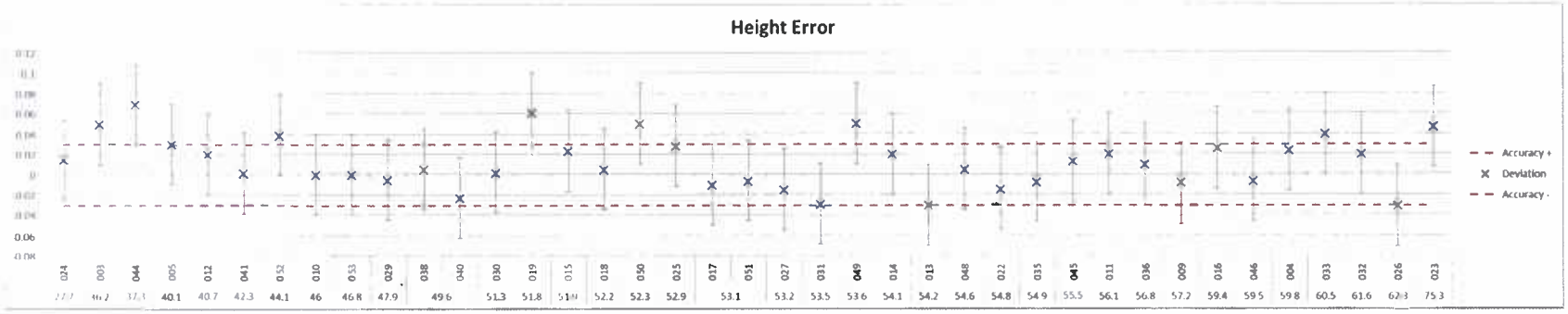

Chart 4.4.1
Please note: Excluded Vehicles # are 001, 002, 006, 007, 008, 020, 021, 028, 034, 037, 039, 042, 043 and 047.

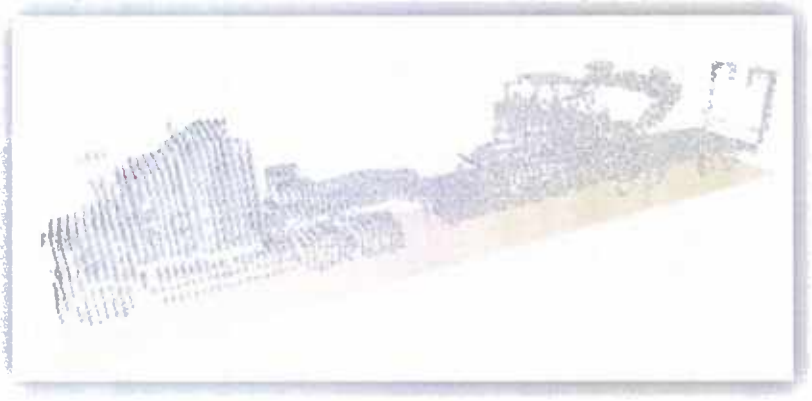

Image 4.4.1 (Vehicle 012)

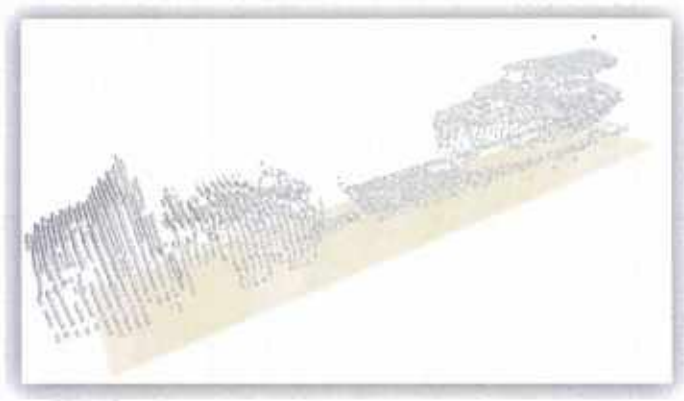

Image 4.4.2 (Vehicle 048)

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5.0 Conclusion

Final results indicate that the FPS is operating within accuracy specification for length, width and height. However, the comparison data for width measurement proved to be unreliable due to the factors mentioned above.

In addition, minimum detectable object size needs to be taken into consideration when using this system for screening vehicles at high speeds

NSW ICAC EXHIBIT

Appendix A – Results Chart Description

Sample Data

Vehicle reference number	Vehicle Speed (km/h)	VPS Measurement (m)	Manual Measurement (m)	Deviation (m)	Deviation (%) = Deviation / Manual Measurement * 100	VPS measurement allowable error (m)	Manual measurement uncertainty (m)
1924	5.58	2.000	1.921	-0.079	-4.11%	± 0.05	± 0.08
1918	5.9904	3.000	2.969	-0.031	-1.04%	± 0.05	± 0.08
1931	6.5772	4.000	4.002	+0.002	+0.05%	± 0.05	± 0.08