

# ALC BULK Routing Tool Project Update

2020/5/8

Shanghai • Apr.. 2020 • Ted Wang  
Transportation



## BULK Routing Tool Update

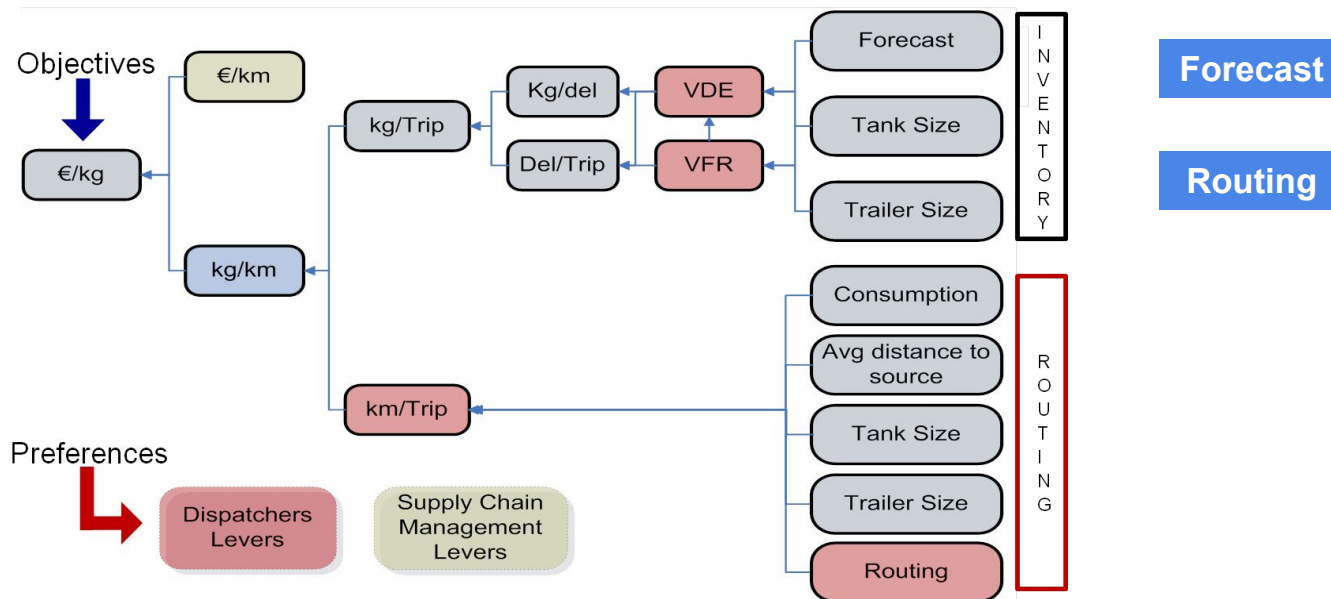
- Project progress overview
- Tool introduction
- Summary of POC
- Q&A

# Bulk Routing Tool Progress Overview

AIR LIQUIDE, THE WORLD LEADER IN GASES, TECHNOLOGIES AND SERVICES FOR INDUSTRY AND HEALTH

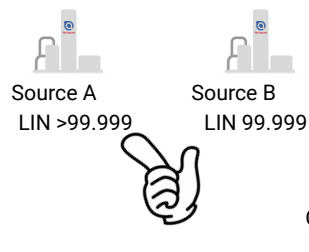
# IM Bulk Routing Tool

## KPI Tree



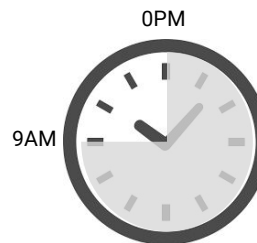
# IM Bulk Routing Tool

## Pain Points



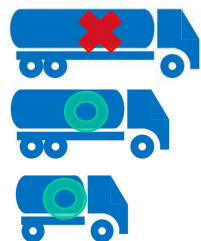
### Source constraints

- Spec
- Purity
- Daily capacity
- ...



### Customer constraints

- Time window
- Traffic permit
- Power status
- ...



### Trailer constraints

- Dimension
- Pump type (Electric...)
- Emission standard
- ...



### Manual Scheduling

- Experience
- Motivation
- Stress
- ...

# IM Bulk Routing Tool

## Overview

Description	Scope	Cost & Saving
<b><u>Background:</u></b> <ul style="list-style-type: none"> <li>To be identified in the content of GYM</li> <li>ATK solution was failed in internal test</li> <li>Intelligent scheduling</li> </ul>	<b><u>POC:</u></b> <ul style="list-style-type: none"> <li>Shandong Region</li> <li>LIN, LOX and LAR</li> </ul>	<b><u>Capex:</u></b> <ul style="list-style-type: none"> <li>OAT Tool – 1M RMB</li> </ul>
<b><u>Purpose:</u></b> <ul style="list-style-type: none"> <li>Use tool to allocate orders and route trailers</li> <li>Assist planner to remember constraints</li> <li>Reduce operational cost</li> </ul>	<b><u>UAT:</u></b> <ul style="list-style-type: none"> <li>Shandong Region</li> <li>LIN, LOX and LAR</li> </ul>	<b><u>Opex:</u></b> <ul style="list-style-type: none"> <li>AIMMIS – 20K RMB</li> <li>TDM – 80K RMB</li> </ul>
<b><u>Objective:</u></b> <ul style="list-style-type: none"> <li>Minimize transportation distance –Km</li> <li>Minimize cost –RMB/Ton</li> <li>Maximize efficiency –Kg/Km</li> </ul>	<b><u>Roll-out:</u></b> <ul style="list-style-type: none"> <li>China</li> <li>LIN, LOX, LAR H2-TT, LCO2, He-TT and NH3</li> </ul>	<b><u>Saving:</u></b> <ul style="list-style-type: none"> <li>5M RMB(3%)</li> </ul> <b><u>The years of Payback :</u></b> <ul style="list-style-type: none"> <li>8 months</li> </ul>

Canonical [spreadsheet](#): 3% savings for all regions, conservative estimate

## Monthly Km saving and rollout:

April - Shandong (10k km)

May - North China (11k km)

June - rest of China (41k km)

ALNC (if phased roll-out)	km	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rest of Mainland (ALEC+ALCC+ALSC)	km	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other APAC (upside)	km	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

P&L

Sales	kRmb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COGS	kRmb	(100)	-	-	82	177	518	518	518	518	518	518	518	518	519	519	519	519	519	519
Routing saving	kRmb	-	-	-	82	177	518	518	518	518	518	518	518	518	519	519	519	519	519	519
AIMMS license cost	kRmb	(20)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(20)
TDM cost (Amap)	kRmb	(80)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(80)
OAT support cost	kRmb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

GM	kRmb	(100)	-	-	82	177	518	518	518	518	518	518	518	518	519	519	519	519	519	519
G&A	kRmb	-	-	-	82	177	518	518	518	518	518	518	518	518	519	519	519	519	519	519
Dep	kRmb	(75)	(75)	(75)	(82)	(82)	(82)	(82)	(82)	(82)	(82)	(82)	(82)	(82)	(82)	(82)	(82)	(82)	(82)	(82)
OIR	kRmb	(175)	(75)	(75)	(1)	92	435	435	435	435	435	435	435	435	436	436	436	436	436	436
CIT	kRmb	-	-	-	-	(22)	(109)	(109)	(109)	(109)	(109)	(109)	(109)	(109)	(109)	(109)	(109)	(109)	(109)	(109)

NE

NE	kRmb	(175)	(75)	(75)	(1)	70	326	326	326	326	326	326	326	326	327	327	327	327	327	327
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Cashflow

NE + Depri add back	kRmb	(100)	-	-	82	153	409	409	409	409	409	409	409	409	410	410	410	410	410	410
Capex	kRmb	(900)	-	-	(100)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WCR change is omitted	kRmb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FCF	kRmb	(1000)	-	-	(18)	153	409	409	409	409	409	409	409	409	410	410	410	410	410	410

Cumul FCF

Cumul FCF	kRmb	(1000)	(1000)	(1000)	(1018)	(864)	(455)	(46)	363	773	1182	1591	2001	2316	2707	3098	3489	3877	4267	4656
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Payback

Payback	months	8.0																		
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Parameters

logistics variable cost Rmb/km	Rmb/km	8.2
depreciation period	months	12
CAPEX 1	kRmb	900
CAPEX 2	kRmb	100
Corporate income tax rate	%	25%

Crosscheck

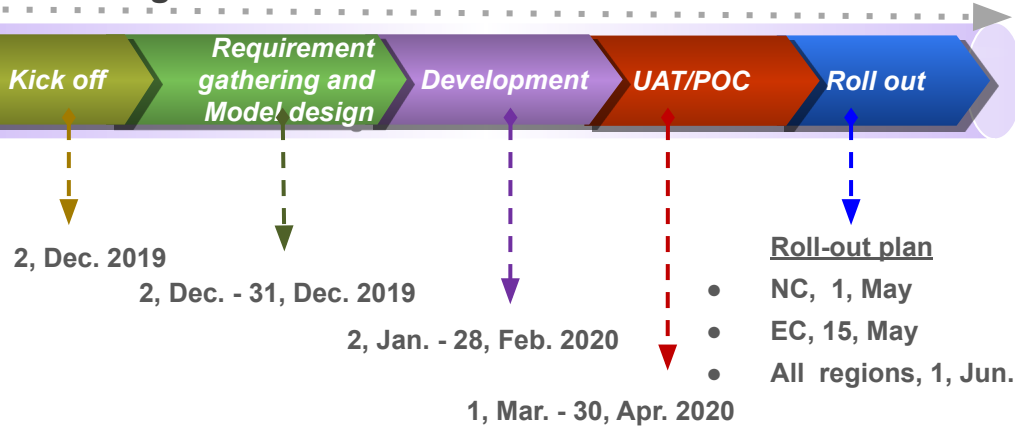
sum of depri is sum of capex	TRUE
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# Hub IT Light Gate Review Process

## Schedule

### Routing Tool Timeline in P1



**On schedule, UAT/POC will be finished by end of April 2020.**

### Project Team

Ted Wang  
PM

Xiuyi Zhou  
Local IT

Ni Jun  
HUB Digital

Raymond  
HUB Digital

Wan Li  
GCC Digital

Xiaobo Hu  
Scheduler

OAT team  
Tool Vendor

Amap team  
TDM Vendor

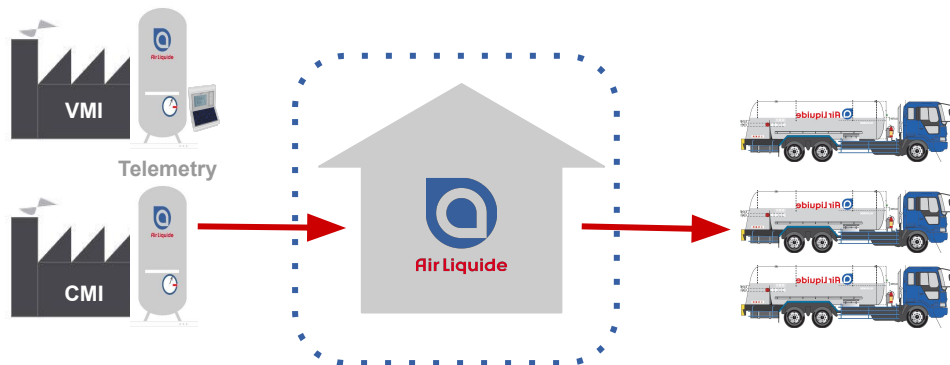


# Routing Tool Introduction

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# IM Bulk Routing Tool

## Introduction



### Input

- Master data
- Daily order
- Daily TDM

Prepare inputs in Excel sheets.

### Routing Tool

### Output

- Route Map
- Trip sequence by trailer
- Daily KPI

Export Excel sheets from AIMMS.

Items	Description
Algorithm	Mathematical model is designed based on Mixed Integer Programming
Solver	CPLEX is an optimization software package produced by IBM
Application	AIMMS is a platform to provide mathematical solution combined with solvers.

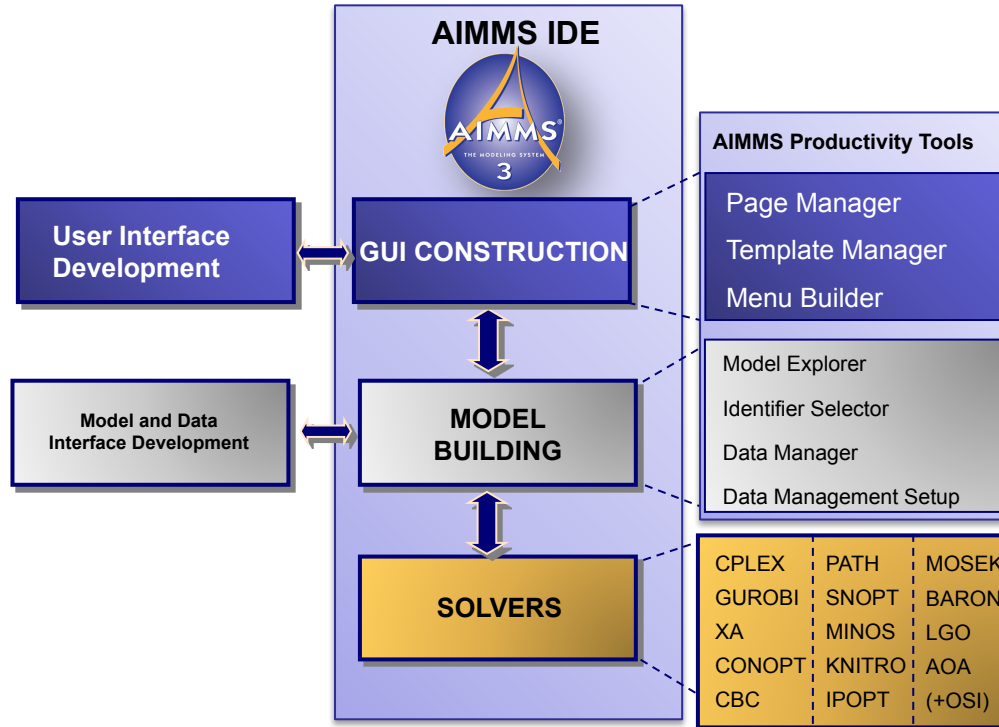


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# IM Bulk Routing Tool

## Introduction

IDE: AIMMS Standalone

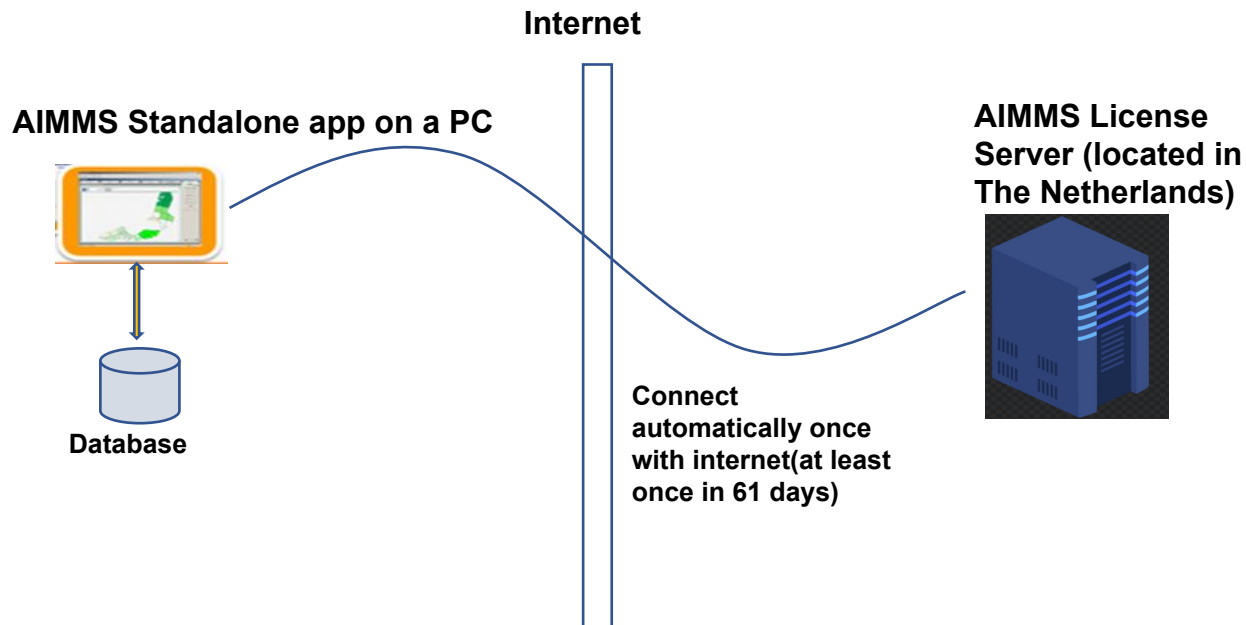


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# IM Bulk Routing Tool

## Introduction

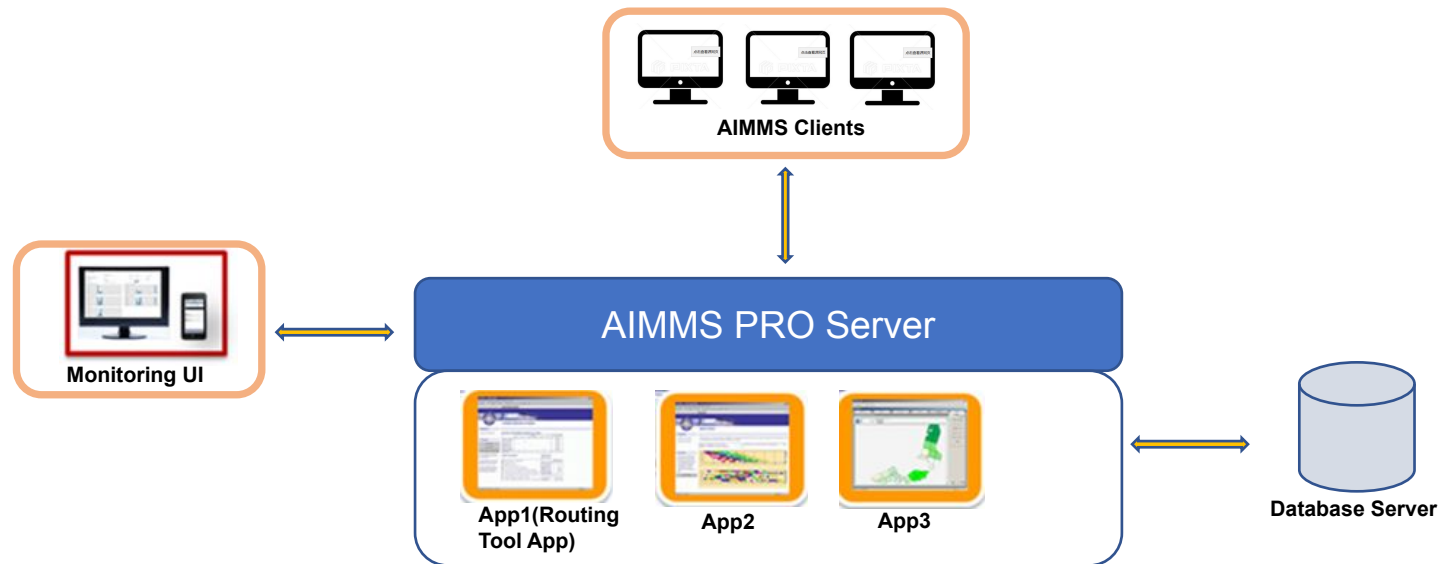
### Standalone: AIMMS Standalone



# IM Bulk Routing Tool

## Introduction

Server based: AIMMS PRO Platform



# Summary in POC

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# IM Bulk Routing Tool

## Current Status

The following outputs are aligned in POC.

### POC

#### Result Summary:

- Tool is helpful and accepted by scheduler
- >3% saving on average for tested 17 daily data
- Running time is less than 30 minutes
  - LOX, 1-5 mins
  - LIN, 5-10 mins
  - LAR ~1 mins

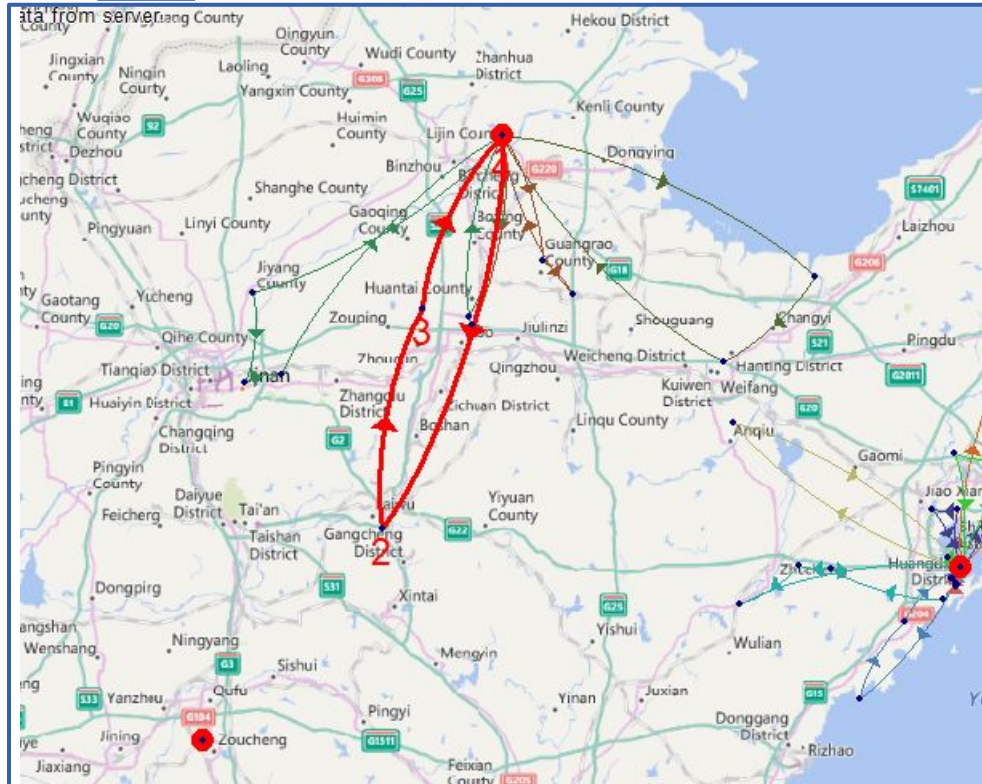
#### Insights:

- Regional optimization vs Depot optimization
- Identify the good surprise on order combination and routes
- Change the scheduler's mindset

Data Date	Product	Orders	Solution Time (min)	Tool Distance (km)	Actual Distance (km)	Saving (km)	Saving (%)
20190419	NI	47	~10	4,114.00	4,768.00	654.00	13.7%
20190719	NI	37	<10	5,195.96	5,327.14	131.18	2.5%
20190801	NI	39	<10	5,486.00	5,659.61	173.61	3.1%
20190802	NI	43	<10	5,949.00	6,237.00	288.00	4.6%
20190703	NI	40	3	4,963.93	5,372.71	408.78	7.6%
20190704	NI	37	5.1	4,601.37	4,964.93	363.56	7.3%
20190905	NI	38	5.3	4,539.78	5,000.88	461.10	9.2%
20190906	NI	38	5.1	4,539.17	5,228.25	689.08	13.2%
20190924	NI	49	11.8	4,574.55	4,916.10	341.55	6.9%
20190925	NI	44	6	5,445.06	5,882.66	437.60	7.4%
20190927	NI	41	4.5	5,593.58	5,642.15	48.57	0.9%
20190824	NI	29	0.8	5,665.93	5,783.35	117.42	2.0%
20190605	OX	28	0.3	5,217.98	5,460.98	243.00	4.4%
20190419	OX	35	1.6	5,274.86	5,700.11	425.25	7.5%
20190822	OX	24	0.3	4,633.74	4,840.22	206.48	4.3%
20191024	AR	7	0.1	1,095.84	1,095.84	0.00	0.00%
20201030	AR	7	0.1	1,205.83	1,277.20	71.37	5.59%
			SUM	78,096.58	83,157.13	5,060.55	6.1%

# IM Bulk Routing Tool

## Current Status



### Learning from Tool

- Tool -- 4539 Km
- Scheduler -- 5228 Km
- **Saving -- 689 Km**
- Unexpected route was identified by Tool

Location ID	Location Name	Arrival Time	Departure Time	Distance (km)	Quantity (UoM)
Depot_ALDY			06:00		27.00
SJC35900	山东黑旋风锯业有限公司	09:52	10:57	205.79	11.59
SJC25200	邹平杰特机械制造有限公司	13:39	14:47	343.63	12.86
ASU_ALDY		17:06	18:22	460.74	27.00
Depot_ALDY		18:22		460.74	27.00



# Support Needed and Next Step

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# IM Bulk Routing Tool

## Support Needed & Next Steps

### *Support Needed*

- AWS cloud instances is required for storing the TDM data
- Speed up the digital approval process (standalone solution)

### *Next steps*

- Release Tool in SD region since April
- Roll out to other regions in China from May

# Q&A

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