

# ATTACHMENT 19 – SHA Computer Architecture Standards for Information Technology

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**SHA Computer Architecture  
Standards for Information Technology  
Updated July 2014**

# SHA Computer Architecture

## Standards for Information Technology

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The State Highway Administration has adopted an "Open Architecture" as a basic Information Processing strategy. This Open Architecture, which makes use of international, national, DOT and industry standards, will ensure that mission critical enterprise information is available to the people who are authorized to receive it, regardless of the specifics of their computing platform. Following these standards is critical if our strategic information, both historical and real-time, is going to be available to serve the customers who need it.

The following sections describe our current computing environment. For the most part, these products have been adopted by SHA because they comply with the Open Architecture philosophy and are widely used throughout the computer industry. Evolutionary developments in the computing world create a continuing need to reexamine and modify our computing environment to ensure that SHA is in alignment with common industry practices. This on-going transition process is reflected in the following software section.

### 1. SOFTWARE

#### 1.1. Operating Systems

The following are the commonly used operating systems within SHA for desktop PC, laptop, mobile and server computing devices:

##### 1.1.1. Desktop PC Devices

**Windows 7 (moving toward Windows 8.1)**

##### 1.1.2. Laptop Devices

**Windows 7 (moving toward Windows 8.1)**

##### 1.1.3. Mobile Devices

- **Apple iOS**
- **Moving forward as a result of BOYD Android will be supported**
- **State owned assets are Apple iOS and Windows 8 Pro for the foreseeable future for Tablets**

##### 1.1.4. Server Devices

**Windows 2008 DatacenterServer –R2 x64 and Windows 2012  
Datacenter Server – R2 x64**

##### 1.1.5. Utilities

For optimal performance in the Windows environment, the disk should be defragmented routinely. The standard utility for this is **-V- locity Version 5**

## **1.2. Database Management System (DBMS)**

The following are the two categories of data within SHA, and the databases to be used for these categories:

### **1.2.1. Level 1**

**(Data to be accessed by individuals external to a particular office or enterprise applications.)**

Preferred DBMS Method – The currently used database for Level 1 **business systems** is **Oracle 11.2.0.3.0**. (Please also see 1.9.3 for database location reference standard.) SHA is in the process of upgrading to Oracle 12c with a tentative completion schedule by the end of the 1<sup>st</sup> Quarter of FY 16.

If possible, SHA would recommend developing databases as schema's in lieu of standalone database. Current development and production environment is supported by Oracle Real Application Clusters (RAC).

Other Supported DBMS Method – Microsoft SQL Server 2012 can also be used for enterprise applications.

**All Level 1 data must reside in industry standard Structured Query Language compliant format.**

### **1.2.2. Level 2**

**(Data pertinent only to a specific office.)**

Level 2 Data is information that is required internally within an office, such as keeping track of employee records and internal documents. The databases for level 2 data are:

OIT Supported methods: **Oracle**

Other supported methods: **Microsoft SQL Server 2012**

Please discuss with OIT before proceeding to determine which method is most acceptable.

**Not recommended for multi-user/office applications: MS Access 2007**

Desktop database products (such as Microsoft Access) are considered desktop productivity tools. They should not be used for multi-user or multi-office applications. (see discussion below re: Microsoft Office).

For data integration between systems, SHA has adopted **Talend** as its standard.

### **1.2.3. Data Classification & Security Categorization**

In an effort to better protect sensitive information and adhere to the DOIT Security policy, the SHA is now categorizing information systems using the NIST FIPS 199 standards as a guideline. Currently the security category is established at the information system level; however, it is anticipated that the SHA will eventually classify each file and folder as well as the data within SharePoint.

These procedures provide a common framework that promotes effective management and oversight of information by determining that data which is viewed as Public and that data which is viewed as Confidential. Formulating and documenting the security category of an information system helps to determine the level of effort for security certification and accreditation. It should be noted that there is an increased cost for maintaining information systems that are classified as confidential. It should also be noted that incorrectly marking a system as public could expose the SHA to unnecessary and potential damaging effects. The balance between these two is key to an effective data governance strategy.

The Federal Information Security Management Act (FISMA) and FIPS 199 discuss three security objectives for information and information systems:

- **Confidentiality**

- “Preserving authorized restrictions on information access and disclosure, including means for protecting personal privacy and proprietary information...” [44 U.S.C., Sec. 3542]
- A loss of *confidentiality* is the unauthorized disclosure of information.

- **Integrity**

- “Guarding against improper information modification or destruction, and includes ensuring information non-repudiation and authenticity...” [44 U.S.C., Sec. 3542]
- A loss of *integrity* is the unauthorized modification or destruction of information.

- **Availability**

- “Ensuring timely and reliable access to and use of information...” [44 U.S.C., SEC. 3542]
- A loss of *availability* is the disruption of access to or use of information or an information system.

### **Potential Impact on SHA and Individuals**

FIPS 199 defines three levels of potential impact on organizations or individuals should there be a breach of security (i.e., a loss of confidentiality, integrity, or availability).

The *potential impact* is **LOW** if

- The loss of confidentiality, integrity, or availability could be expected to have a **limited** adverse effect on organizational operations, organizational assets, or individuals.

The *potential impact* is **MODERATE** if

- The loss of confidentiality, integrity, or availability could be expected to have a **serious** adverse effect on organizational operations, organizational assets, or individuals.

The *potential impact* is **HIGH** if

- The loss of confidentiality, integrity, or availability could be expected to have a **severe or catastrophic** adverse effect on organizational operations, organizational assets, or individuals.

For an information system, the potential impact values assigned to the respective security objectives (confidentiality, integrity, availability) shall be the highest values (i.e., high water mark) from among those security categories that have been determined for each type of information resident on the information system.

The generalized format for expressing the security category, SC, of an information system is:

SC information system = {(**confidentiality**, *impact*), (**integrity**, *impact*), (**availability**, *impact*)}, where the acceptable values for potential impact are LOW, MODERATE, or HIGH.

The SHA evaluates each information system through a series of questions (Data Classification Template) to determine its classification and security categorization. Information is classified as public, internal or confidential. Handling requirements exist for each classification level. Public is able to be placed in such a way that it is accessible to the general public, though due care should be exercised to preserve its integrity and availability. Internal, requires standard internal network security controls such as complex passwords, behind the MDOT firewall. Finally confidential requires implementing security controls and handling requirements mentioned in the DoIT information security policy and NIST security standards publications (such as encryption at rest and in transit).

SHA has adapted “NIST’s Risk Management Framework” to manage risk associated with information systems. For all new Information systems, SHA will produce an Authorization to Operate (ATO) document that verifies security controls have been adequately implemented (or plan to be implemented) to protect confidential information. The ATO constitutes SHA’s acknowledgement and acceptance of risk associated with the system. Custodians of confidential information will, via the completion of

a security authorization form, verify the completeness and propriety of the security controls used to protect it before initiating operations.

### **1.3. Development Tools**

The following tools are used for front-end development for the DBMS:  
SHA supports CLOUD Computing via **SalesForce.com** with **Eclipse** as the supported development tool, **Visual Force** as the framework and **APEX** as the programming language. On any new & re-platform / reengineering development, CLOUD Computing is considered first before other development tools are considered. Other SHA development platforms, such as .Net or Sharepoint, can be used when justified and recommended by a review panel and then approved by OIT Leadership.

**PowerBuilder 11** (Maintenance Only)  
**MS Visual Studio 2008, 2010 and 2012 as IDE using Visual Basic.NET, ASP.NET and C#.NET as programming languages.**  
**MS Visual Studio 2012 will be used for all new approved .NET applications.**  
**SharePoint Designer for SharePoint pages**  
**Visual Basic.Net**  
**MS Access 2007** (see discussion below re: Microsoft Office)  
**Microsoft's Team Foundation Server is currently being used for configuration management and source control**  
**Flex 4.6**

The following tools are used for report development: **SQL Server Reporting Services**, Salesforce.com Reporting and Dashboards in addition to QlikView and SharePoint for Business Intelligence.

For single sign on, SHA currently supports **Microsoft Windows Active Directory**.

### **1.4. Internet/Intranet Applications**

The software for Internet browsing, on SHA computers, is **Microsoft Internet Explorer**. As Web pages are developed; they will be tested for compatibility with the most popular browsers used.

**Microsoft SharePoint** is used for both SHA's Internet and Intranet portals.

**SQL Server Reporting Services (SSRS)** will be used for server-based reporting.

The graphics tool for Web development is **Adobe Photoshop**.

**Adobe Acrobat Writer** will be used to create PDF documents.

**Microsoft Internet Information Server 7**.

**Web Content Management** –Microsoft Office SharePoint Services.

**Worldspace® by Deque Systems, Inc. is used for Section 508 compliance.**

**Google Analytics** – is used as SHA's web analysis tool.

## **1.5. Electronic Mail & Scheduling**

The E-mail/Scheduling software package **Microsoft Outlook 2007 clients connected to Microsoft Exchange Server 2007.**

## **1.6. Office Automation Products**

SHA has adopted **Microsoft Office 2007 Professional** as its standard office automation product. Microsoft Office 2013 will be the next version that SHA migrates to, pending MDOT compatibility.

### **1.6.1. Word Processing**

**Word 2007**

### **1.6.2. Spreadsheets**

**Excel 2007**

### **1.6.3. Business Graphics**

**PowerPoint 2007**

## **1.7. Project Management**

The project management packages are **Microsoft Project 2007, Microsoft Visio 2007, and SharePoint 2007** for documentation of project artifacts and collaboration, and **Innotas (www.innotas.com)** for tracking project & new requests.

## **1.8. Computer Aided Design & Drafting (CADD)**

Computer Aided Design & Drafting software is used to develop preliminary and final engineering contract documents and to perform engineering functions in the creation of the documents and map products. The following are the CADD software packages:

### **1.8.1. Drafting**

**Bentley MicroStation Version V8i Select Series or later with up-to-date SHA CADD Standards**

### **1.8.2. Design**

**Bentley InRoads V8i Select Series 1 version 8.11 or later  
Bentley GeoPak, version 8.11 or later**

### **1.8.3. Development Language**

MicroStation has a complete development environment called **MicroStation Development Language (MDL)**, which is a customized CADD development environment based on the C programming language. Additionally, **Visual Basic** may also be used to develop MicroStation applications.

### **1.8.4. Engineering Plan Document Management**

**Bentley Project Wise V8i**



## **1.9. Geographic Information Systems (GIS)**

Geographic Information Systems software is used to relate geo-referenced data, located in a Relational Database Management System (RDBMS) with digital mapping files. The following preferred GIS software environment includes all associated products:

**1.9.1.** For any new GIS application (web or desktop) or data development the GIS team should be consulted to reduce any duplication of efforts and guidance.

GIS Team can be contacted at [GIS@sha.state.md.us](mailto:GIS@sha.state.md.us)

### **1.9.2. Geographical User Interface**

**ESRI ArcGIS Suite 10.0 or higher; Internet Explorer vX or higher or Google Chrome with Adobe Flash 10 or higher**

### **1.9.3. RDBMS**

**Oracle 11g R2 with ESRI ArcSDE for Spatial Data**

### **1.9.4 GIS Server**

**ArcGIS Server Standard Enterprise 10.0 or higher**

### **1.9.5 Linear Location Reference (Current) Standard**

There has been general agreement by the members of the GIS TAC (Technical Advisory Committee) that all tabular databases from which point or linear features are to be designated on maps will conform to the HISD LRS (Location Reference Standard) by including the following field names and characteristics in those databases. (Note: The LRS fields are used by GIS software to locate point and linear features.)

<b>Name</b>	<b>Field Name</b>	<b>Type</b>	<b>Length</b>	<b>MS/Access Equivalent</b>
County	county	small integer	2	integer
Municipal Sort Code	mun_sort	small integer	3	integer
Route Prefix	id_prefix	character	2	character
Route Number	id_rte_no	small integer	4	integer
Route Suffix	mp_suffix	character	2	character
Mile Point	id_mp	decimal	4,2	number, single
(and below for linear features)				
Section Length or	section_length	decimal	5,2	number, single
Ending Mile Point	end_mp	decimal	4,2	number, single
Global Route ID	global_route_id	number	32 max	integer
Subroute ID	sub_route_id	number	32 max	integer

Please include these fields and their content in the database to facilitate the loading of your data on the GIS server.

The Maryland State Highway Administration has implemented a new standard for the Route Identifier within the OPPE Data Services and Engineering Division (DSED). This new standard will be implemented for the remainder of the Administration as other systems require the new capabilities.

**ROUTE\_ID (Route Identifier)**

The RouteID is used by GIS software to locate points and line segments on the SHA road centerline. It is a concatenation of county, mun\_sort, id\_prefix, id\_rte\_no, and mp\_suffix, mp\_direction, cal\_direction, assoc\_id\_prefix, exit\_number and ramp\_number or similarly named fields. The result is a thirty-two character field since each of the originating fields is converted to character form as part of the concatenation. Further explanation of RouteID follows the table. The RouteID is comprised of the following fields:

County	number	1-2	(see table below for values)
mun_sort	number	3-5	if id_prefix = MU, mun_sort value, else 000 (see table below for values)
id_prefix	Char(2)	6-7	(see table below for values)
id_rte_no	Char(5)	8-12	(00000 to 99999)
mp_suffix	Char(2)	13-14	SC= Scenic, BU = Business, or any other characters needed for coding -if no significant characters, must be blank, not null
mainline	number	15-16	Used to classify the road mileage of the inventoried road as follows: Mainline, Interchange Ramps, Service Roads, Couplet, etc. (see table below for values)
mp_direction	Char(1)	17	The direction in which the road was inventoried. IS, US, MD, and major MU and CO routes are inventoried either West to East or South to North. Minor county (CO) and municipal routes (MU) do not follow this pattern.
cal_direction	Char(1)	18	The direction of increasing mile points for single roadways. Dual roadways are calibrated in the direction of inventory on the inventory side of the route and in the opposite direction on the non-inventory side. Mile points increase in either direction.
Ramps have different coding needs and use the following additional fields. (id_prefix = "RP")			
assoc_id_prefix	Char(2)	19-20	The id_prefix for the mainline route to which the ramp is associated.
exit_number	Char(10)	21-30	The mileage-based exit number of the mainline route. Left justified.
ramp_number	number	31-32	The ramp number follows the standard ramp numbering scheme as established in the SHA Standard Interchange Plan.
In addition to RouteID, milepoint fields indicate the location of the event.			

id_mp	Decimal(6,3)		required number field with 6 digits left of decimal point and 3 to the right. This field is used for point features (events).
end_mp	Decimal(6,3)		optional number field with 6 digits left of decimal point and 3 to the right. This field is necessary if the feature (event) is linear.

### RouteID

In order to support ramps and reverse lanes on divided highways in a manner consistent with the SHA HPMS database, additional attributes were added to the previously used NLF\_ID. These are, MP\_DIRECTION, CAL\_DIRECTION, MAINLINE, ASSOC\_ID\_PREFIX, EXIT\_NUMBER, and RAMP\_NUMBER. The addition of these fields resulted in a required length of 32 characters for the RouteID

Characters 1 – 14 follow the standard NLF\_ID format.

Characters 15 – 16 contain the mainline code which is used to classify the roadway as to mainline, ramp, service road, couplet, etc.

Characters 17 – 18 house the two directional fields (inventory direction and calibration direction). For non-divided (single centerline) routes, the inventory direction and calibration are the same (NN for example). For divided highways with two centerlines, the “reverse” lane’s calibration direction is opposite of the inventory direction (NS for the south-bound lane of a route inventoried south to north).

For ramps, characters 19 – 32 are used as follows: The associated id\_prefix in spaces 19 and 20 is required (generally IS, US, MD). Characters 21 – 30 (10 characters) are reserved for exit number although generally only 3 or less are needed. Spaces (not nulls) are used as filler character for the exit number. Characters 31 and 32 are used for the ramp number. This numeric field is coded as numeric fields in the NLF\_ID, “01”, “02”, “03”, etc.

For any route other than ramps, characters 19 – 32 are coded with a series of asterisk (\*).

Examples:

RouteID: 01041MU00760 01NN\*\*\*\*\* (note length is 32 characters)

This is municipal route 760 in mun\_sort (municipality code) 41 (Cumberland) in county 1. The mun\_sort is not used unless the id\_prefix (route prefix/type) is “MU”. If the id\_prefix is not “MU”, then the mun\_sort is “000”. There is no suffix (2 spaces), it is a mainline route, and we have assumed the inventory direction is North for this example, the calibration direction is also North.

RouteID: 01000MD00948AM01NN\*\*\*\*\* (note length is 32 characters)

This is MD route 948AM in county 1.

Ramp Examples:

RouteID: 13000RP00100 02EEMD4 08 (note length is 32 characters)

This route ID indicates a ramp (RP) on MD100 traveling E (Calibration direction is E). It is Exit number 4 and the ramp number is 8.

RouteID: 13000RP00100 02EWMD4A 01  
13000RP00100 02EWMD4B 02

The ramp exit “number” often includes characters (A and B for example). The two examples above are for exits 4A and 4B on MD 100 in Howard County traveling in the westbound lane with ramp numbers of 1 and 2.

**Global\_Route\_ID:** This is a number that identifies routes, both sides of the routes having the same global route ID

**Sub Route ID:** Each side of the route has a sub\_route\_id which along with the global\_route\_id makes the record unique.

Example of Global\_Route\_ID and Sub\_route\_id

Global_route_id	Sub_route_id	RouteID
805	1	01000IS00068 01EE*****
805	2	01000IS00068 01EW*****

So in this case 805 is the global\_route\_id from route IS68 in county 1. Sub\_route\_id of 1 points to the inventory side of the route and sub\_route\_id of 2 points to the non\_inventory side of the route.

Tables

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County field values

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- 01 ALLEGANY
- 02 ANNE ARUNDEL
- 03 BALTIMORE
- 04 CALVERT
- 05 CAROLINE
- 06 CARROLL
- 07 CECIL
- 08 CHARLES
- 09 DORCHESTER
- 10 FREDERICK

- 11 GARRETT
- 12 HARFORD
- 13 HOWARD
- 14 KENT
- 15 MONTGOMERY
- 16 PRINCE GEORGES
- 17 QUEEN ANNES
- 18 ST MARYS
- 19 SOMERSET
- 20 TALBOT
- 21 WASHINGTON
- 22 WICOMICO
- 23 WORCESTER
- 24 BALTIMORE CITY

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mun\_sort field values

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Mun_sort	County	Incorporated Town
1	12	ABERDEEN
2	11	ACCIDENT
3	2	ANNAPOLIS
4	17	BARCLAY
5	15	BARNESVILLE
6	1	BARTON
7	12	BEL AIR
8	23	BERLIN
9	16	BERWYN HEIGHTS
10	14	BETTERTON
11	16	BLADENSBURG
12	21	BOONSBORO
13	16	BOWIE
14	16	BRENTWOOD
15	15	BROOKEVILLE
16	9	BROOKVIEW
17	10	BRUNSWICK
18	10	BURKITTSVILLE
19	9	CAMBRIDGE
20	16	CAPITOL HEIGHTS
21	16	NEW CARROLLTON
22	7	CECILTON
23	17	CENTREVILLE
24	7	CHARLESTOWN
25	4	CHESAPEAKE BEACH
26	7	CHESAPEAKE CITY
27	14	CHESTERTOWN
28	16	CHEVERLY
29	15	CHEVY CHASE SECTION III
30	15	TOWN OF CHEVY CHASE

mun_sort field values		
Mun_sort	County	Incorporated Town
31	15	CHEVY CHASE SECTION V
32	15	CHEVY CHASE VIEW
33	15	CHEVY CHASE VILLAGE
34	9	CHURCH CREEK
35	17	CHURCH HILL
36	21	CLEAR SPRING
37	16	COLLEGE PARK
38	16	COLMAR MANOR
39	16	COTTAGE CITY
40	19	CRISFIELD
41	1	CUMBERLAND
42	11	DEER PARK
43	22	DELMAR
44	5	DENTON
45	16	DISTRICT HEIGHTS
46	15	DRUMMOND
47	16	EAGLE HARBOR
48	9	EAST NEW MARKET
49	20	EASTON
50	16	EDMONSTON
51	9	ELDORADO
52	7	ELKTON
53	10	EMMITSBURG
54	16	FAIRMOUNT HEIGHTS
55	5	FEDERALSBURG
56	16	FOREST HEIGHTS
57	10	FREDERICK
58	15	FRIENDSHIP HEIGHTS
59	11	FRIENDSVILLE
60	1	FROSTBURG
61	22	FRUITLAND
62	21	FUNKSTOWN
63	15	GAITHERSBURG
64	14	GALENA
65	9	GALESTOWN
66	15	GARRETT PARK
67	16	GLENARDEN
68	15	GLEN ECHO
69	5	GOLDSBORO
70	11	GRANTSVILLE
71	16	GREENBELT
72	5	GREENSBORO
73	21	HAGERSTOWN
74	6	HAMPSTEAD
75	21	HANCOCK

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mun\_sort field values

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Mun_sort	County	Incorporated Town
76	12	HAVRE DE GRACE
77	22	HEBRON
78	5	HENDERSON
79	2	HIGHLAND BEACH
80	5	HILLSBORO
81	9	HURLOCK
82	16	HYATTSVILLE
83	8	INDIAN HEAD
84	21	KEEDYSVILLE
85	15	KENSINGTON
86	11	KITZMILLER
87	16	LANDOVER HILLS
88	8	LA PLATA
89	16	LAUREL
90	15	LAYTONSVILLE
91	18	LEONARDTOWN
92	11	LOCH LYNN HEIGHTS
93	1	LONACONING
94	1	LUKE
95	6	MANCHESTER
96	22	MARDELA SPRINGS
97	15	MARTINS ADDITION
98	5	MARYDEL
99	10	MIDDLETOWN
100	1	MIDLAND
101	14	MILLINGTON
101	17	MILLINGTON
102	16	MORNINGSIDE
103	6	MOUNT AIRY
103	10	MOUNT AIRY
104	16	MOUNT RAINIER
105	11	MOUNTAIN LAKE PARK
106	10	MYERSVILLE
107	10	NEW MARKET
108	6	NEW WINDSOR
109	4	NORTH BEACH
110	16	NORTH BRENTWOOD
111	15	NORTH CHEVY CHASE
112	7	NORTHEAST
113	11	OAKLAND
114	15	OAKMONT
115	23	OCEAN CITY
116	20	OXFORD
117	7	PERRYVILLE
118	22	PITTSVILLE
119	23	POCOMOKE CITY
120	15	POOLESVILLE

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mun\_sort field values

Mun_sort	County	Incorporated Town
121	7	PORT DEPOSIT
122	5	PRESTON
123	19	PRINCESS ANNE
124	17	QUEEN ANNE
124	20	QUEEN ANNE
125	17	QUEENSTOWN
126	5	RIDGELY
127	7	RISING SUN
128	16	RIVERDALE
129	14	ROCK HALL
130	15	ROCKVILLE
131	10	ROSEMONT
132	20	ST MICHAELS
133	22	SALISBURY
134	16	SEAT PLEASANT
135	9	SECRETARY
136	21	SHARPSBURG
137	22	SHARPTOWN
138	21	SMITHSBURG
139	23	SNOW HILL
140	15	SOMERSET
141	17	SUDLERSVILLE
142	6	SYKESVILLE
143	15	TAKOMA PARK
143	16	TAKOMA PARK
144	6	TANEYTOWN
145	5	TEMPLEVILLE
145	17	TEMPLEVILLE
146	10	THURMONT
147	20	TRAPPE
148	6	UNION BRIDGE
149	16	UNIVERSITY PARK
150	16	UPPER MARLBORO
151	9	VIENNA
152	10	WALKERSVILLE
153	15	WASHINGTON GROVE
154	1	WESTERNPORT
155	6	WESTMINSTER
156	22	WILLARDS
157	21	WILLIAMSPORT
158	10	WOODSBORO
159	8	PORT TOBACCO
999	24	BALTIMORE CITY

id\_prefix field values

Id_prefix	Description
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MD	Maryland Route
US	United States Route
IS	Interstate Route
CO	County Road
MU	Municipal Road
RP	Ramp
SR	State Road
GV	Government Road
OP	Other Public Road

Mainline field values

MAIN_LINE	DESCRIP	ABBREV
1	MAINLINE	MAIN
2	INTERCHANGE RAMP	INT RAMP
3	SERVICE ROAD	SRV RD
4	SPURS	SPURS
5	CD	CD
6	OUT OF SIGHT LANE	OUT SITE
8	COUPLET NI DIR	COUPLET NI DIR
7	COUPLET INV DIR	COUPLET INV DIR

### **1.9.6 GPS Data Collection & Mapping Receivers**

**Mapping & GIS GPS Receivers**, not limited to, but recommended,  
Trimble GEO XT or XH Handheld receivers

### **1.9.7 GPS Data Collection Software**

Not limited to, but recommended, TerraSync Standard or Professional 5.3  
or higher

### **1.9.8 GPS Processing Software**

Pathfinder Office 5.3 or higher  
(License Manager for Pathfinder Office at SHA, SHAHISDCLP)

**For additional GIS related GPS data collection standards,  
configurations, recommendations and best practices, the GIS team  
should be consulted.**

**GIS Team can be contacted at [GIS@sha.state.md.us](mailto:GIS@sha.state.md.us)**

## 2. NETWORK ENVIRONMENT

### 2.1. Network Protocols

The following are the network protocols used by SHA:

**TCP/IP**  
**SSH**  
**FTP**  
**SCP**  
**SMTP**  
**HTTP**  
**HTTPS**  
**SFTP**  
**SSL**  
**Fiber Channel**  
**iSCSI**

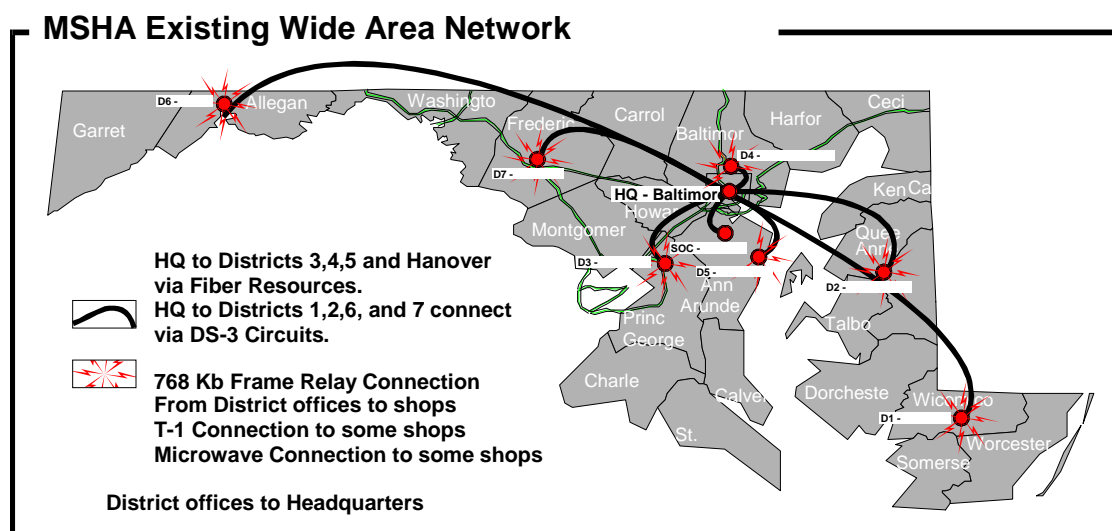
### 2.2. Network Topology

The following are the network topologies used by SHA:

**Switched Ethernet (100Base-T, 1000Base-T)**  
**Fast Ethernet (100Base-T, 1000Base-T, 10000Base-T)**

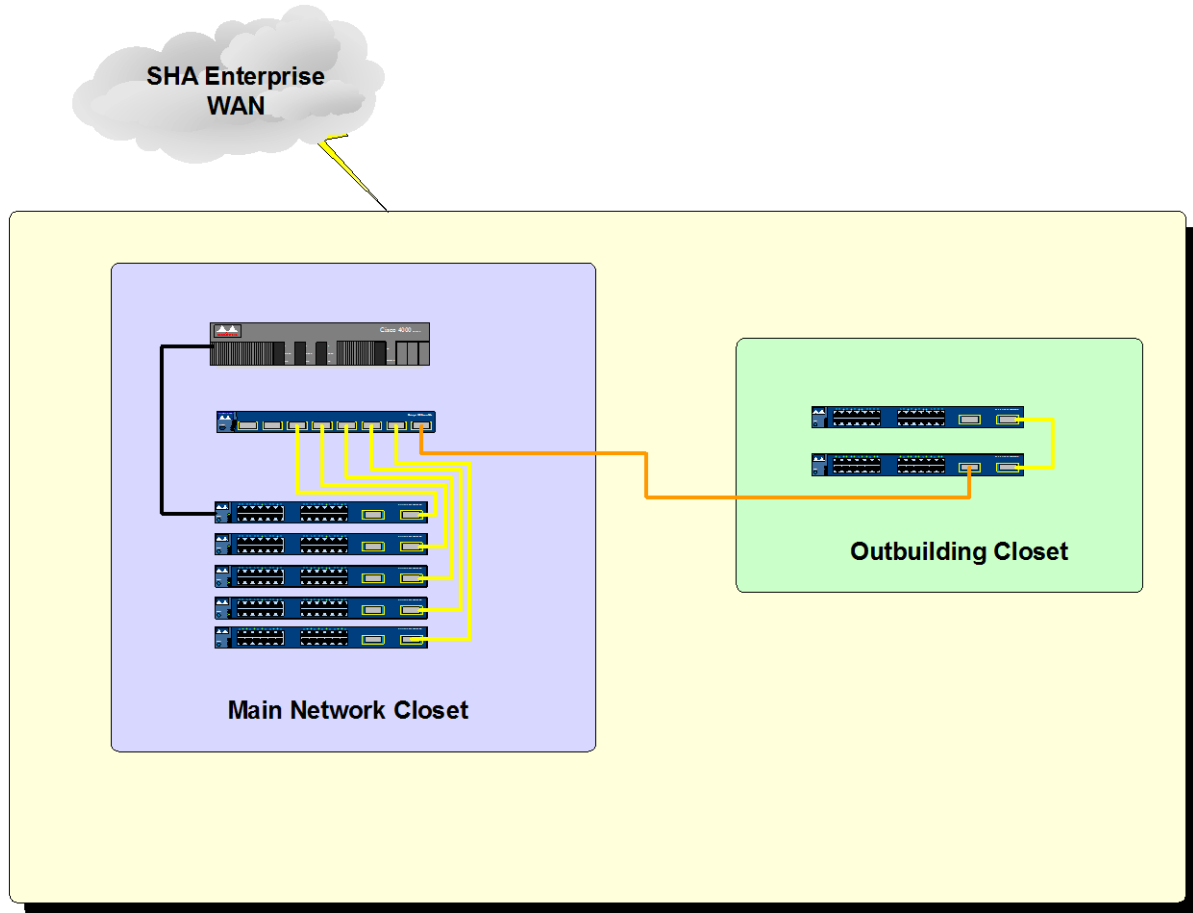
### 2.3. Network Configuration

The SHA computer network extends to various offices, with the Headquarters complex serving as the hub. Cisco model 2500, 3000, 4000, and 7000 routers at the Headquarters with fiber connectivity to the SHA Operations Center at Connelley Drive, Hanover, and to most District offices with the remaining Districts having T-1 connectivity. Verizon Ethernet Everywhere (EE) service, Frame relay and T-1/ISDN allows the maintenance shops, of which there are an average of four per District, to connect into the District to reach file/print servers located at the District and/or at Headquarters. (Figure 1)



**Figure 1. Existing SHA WAN Connectivity**

Each of the District Offices contains a local LAN as shown in the drawing below:



**Figure 3. Network configuration at SHA District office**

The Office of Traffic & Safety, at Connelley Drive, is running a 1000 Base-T Ethernet and is connected to the SHA Operations Center. The SHA Operations Center, including the Office of Maintenance, has installed a twisted pair Ethernet and fiber, and is connected to the rest of SHA via fiber.

#### **2.4. Data Storage**

SHA enterprise storage consists of two HP/3PAR v400 (one at HQ and one at HANOVER) for primary storage. Secondary storage consists of HPP4500 iSCSI and 3PAR 7400 iSCSI as well as NetApp n6040 for disk to disk backups. Remaining data is stored on Direct Attached Storage. Both FC and iSCSI storage are being replicated using bi-directional synchronization between HQ and HANOVER Datacenters.

Districts 1, 2, and 7 are using DROBO B800i iSCSI SAN.

### **2.5. Back up Solution**

SHA uses Syncsort Backup Express to backup its enterprise data (including SHA HQ and Districts 3,4,5 and 6) at Headquarters and Hanover locations to perform block level backups. Districts 1, 2, and 7 replicate local Windows-based file system data to SHA HQ via Microsoft DFS and backup of this data occurs at SHA HQ. Backup data is replicated between HQ and Hanover.

### **2.6. VM Ware**

SHA currently has multiple VMWare vSphere 5.5 server farms for development and production. VMware environments are connected to 3PAR v400 (primary) and P4500/3PAR 7400 (secondary) storage and backed up with Syncsort's Backup Express. Districts 1, 2, and 7 contain their own vSphere 5 clusters to house their local file, print, and authentication services. Their shared storage consists of a DROBO B800i SANs. Data from these District servers are replicated to HQ via Microsoft DFS and backed up using Syncsort's BackupExpress.

## **3. HARDWARE REQUIREMENTS**

Although SHA has varying levels of hardware, any new hardware systems should meet the following minimum requirements.

### **3.1. Office Automation Workstations**

These machines should have the following minimum configuration:

Intel Core i5-4570 3.2G 6M HD 4600 CPU  
4 Gb RAM  
500 Gb 7200 RPM 3.5 Hard Drive  
8X DVD+/-RW DVD-ROM  
21" Ultra sharp Flat Panel color monitor,  
10/100 PCI 32-bit Ethernet card  
5/5/5 year (material/labor/onsite) SFF Warranty US

### **3.2. CADD/GIS Development Workstations**

These machines should have the following minimum configuration:

Intel Core i7-4770 3.4 GHz (up to 3.9 GHz) 8MB 84W Intel HD Graphics 4600  
4C HT CPU  
4 Gb RAM  
500 GB 7200 RPM SATA SFF 1st SED HDD  
16X SuperMulti DVDRW SATA 1st ODD  
21" Ultra sharp Flat Panel color monitor  
10/100 PCI 32-bit Ethernet card  
HP 5/5/5 year SFF Warranty US

### **3.3. Laptops**

These machines should have the following minimum configuration:

Intel® Core™ i5-4330M Dual Core Processor  
4 Gb RAM  
250 GB 7200 rpm SATA hard drive  
DVD±RW SuperMulti DL Drive  
Wireless accessible

HP 5 year NBD Onsite NB Only HW Support

### **3.4. Tablets**

These machines should have the following minimum configuration:

Mobile broadband card  
WiFi  
4 GB RAM  
64GB Solid State Drive  
1 year manufacturer's warranty

### **3.5. ESX Server**

Blade architecture consisting of the following minimum configuration:

Six Core Intel XEON 2.6 GHz  
96Gb RAM  
8 Network Interface Cards  
Two(2) 72gb internal drives, mirrored as RAID 1  
Storage Area Network SAN attached shared drives, striped as RAID 5

### **3.6. Database Servers – Windows 2008 R2 64 Bit Operating System**

These machines should have the following minimum configuration:

Multi-processor (2) Dual-Core Intel® Xeon® Processor @ 3.00 GHz  
32 Gb RAM  
Two (2) 146 gb internal drives, mirrored as a RAID 1  
Storage Area Network (SAN) attached shared drives, striped as RAID 5

## **4. Security Requirements**

Systems developed for SHA must comply with "*State of Maryland Information Technology Security Policies*", which can be found at the following URL:  
<http://doit.maryland.gov/support/Pages/SecurityPolicies.aspx>

In addition to complying with the State's IT Security Policies systems developed for SHA must also comply with MDOT's Security Policy (available upon execution of a Non-Disclosure Agreement) and the following additional requirements must be met wherever applicable and practicable.

### **4.1. Log-on Accounts**

All remote users (whether customers or contractor support) must notify SHA immediately when an employee resigns or his/her employment is terminated so that the log-on account including their VPN token and account (if applicable) can be disabled. (SHA's Employee Services and Employer-Employee Relations Divisions notify internally.) The log-on account will not be "inherited" by another employee. A new account must be established.

### **4.2. Security for Remote Users**

1. A remote application must establish a "captive account." i.e., The remote customer must connect directly into the application; he/she must not log onto

a server and then have an option of whether or not he/she will run the application. This ensures that the remote user performs only the operations for which he/she is authorized.

2. When contractor support personnel are granted remote log-on privileges, trustee rights on the account will be set only to the specific directories necessary.
3. All applications which are not outside SHA's firewall must provide additional security by requiring the remote customer to dial in to SHA's authentication server, to provide auditing and authentication.

#### **4.3. Virus Protection**

Virus protection software **must** be utilized on all platforms – desktops, laptops and servers. The preferred tool for this purpose is McAfee **VirusScan Enterprise** for servers and clients.

## **ATTACHMENT 20 – SHA MATERIALS & SUPPLIES INVENTORY PROCESS OVERVIEW DOCUMENT**

### **Introduction**

The following documentation has been provided to give respondents an indication of the size, scope and processes related to SHA's Materials & Supplies Inventory. The documentation is intended to function as a broad overview and should not be taken as current (As-Is) or proposed (To-Be), detailed documentation of SHA's Materials & Supplies Inventory business process. The overview is provided in the IDEF0 Functional Modeling Method format.

### **History**

During Fiscal Year 1998 (07/01/97 – 06/30/98), SHA convened a cross-sectional team to define current and future business processes related to the Materials & Supplies Inventory. The process scenarios were captured and documented using the IDEF0 Functional Modeling Method format. Budget constraints that existed at the time precluded SHA from developing an application based upon the To-Be Functionality documented in the IDEF0 process. While some parts of the existing and desired business processes have changed, a large majority of the captured information is still valid.

### **Current Materials & Supplies Inventory**

SHA currently has 35 Materials & Supplies Inventory locations with inventory valued at \$37.9 million as of June 30, 2012. These inventory locations are situated throughout the State of Maryland. The inventories consist of a variety of items including road salt, automobile and truck parts, highway signs and bulk fuel. SHA also maintains an inventory location (Sign Shop) that purchases raw materials, fabricates highway signs, and stores the fabricated signs. This one location must maintain and account for three types of inventory: raw materials (sign blanks, reflective sheeting), Work-In-Process (WIP), and Finished Signs.

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## **MANAGE INVENTORY**

### **AS-IS IDEFO PROCESS MODEL**

**Prepared for:**  
**State Highway Administration**  
**(SHA)**  
**Publication: February 4, 1998**



**STATE HIGHWAY ADMINISTRATION**  
**MANAGE INVENTORY ACTIVITY**  
**AS-IS IDEF0 PROCESS MODEL**

**Introduction**

This document represents the Management Inventory AS-IS IDEF0 process model for the State Highway Administration (SHA). The model consists of an IDEF0 process model with process model definitions identified in the glossary of the document.

**Viewpoint**

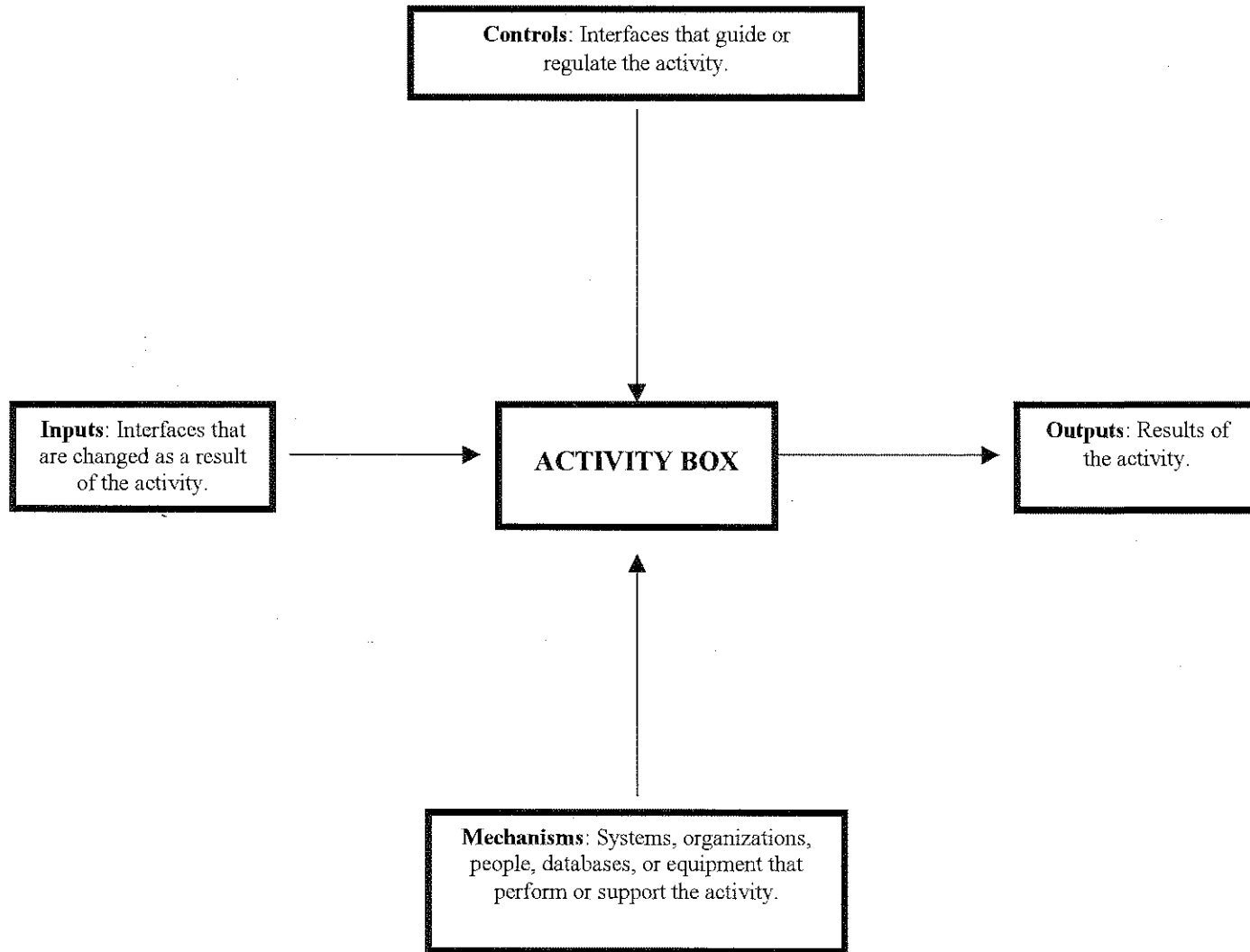
The viewpoint is the point of view that is assumed when constructing the model. The SHA JAD 1 participants identified the viewpoint of the Manage Inventory AS-IS IDEF0 Process activity to be that of the State Highway Administration Inventory Management Staff.

**Purpose**

The purpose is the statement of why the model is being constructed. The purpose statement is a clear statement of what the model will be used to accomplish. Inventory management staff determined that the purpose of the "Management Inventory Program" is to:

- Provide day to day inventory functionality
- Be effective and efficient
- Eliminate the reentering of duplicate data
- Provide accurate inventory counts
- Provide user friendly reporting capability/outputs
- Have the ability to identify the level, mix, and proper inventory at the proper location
- Identify overstock and obsolete materials
- Provide the basis for the reorder report
- Provide the capability to record accounting and transfers to FMIS and other systems as identified
- Comply with internal controls such as security
- Provide real time inventory

## IDEF0 ACTIVITY CONVENTIONS



### **Context Diagram**

The context Diagram is established for the activity on the A-0 diagram. The context is the way in which the activity "Manage Inventory Program Activity" interfaces with the larger world.

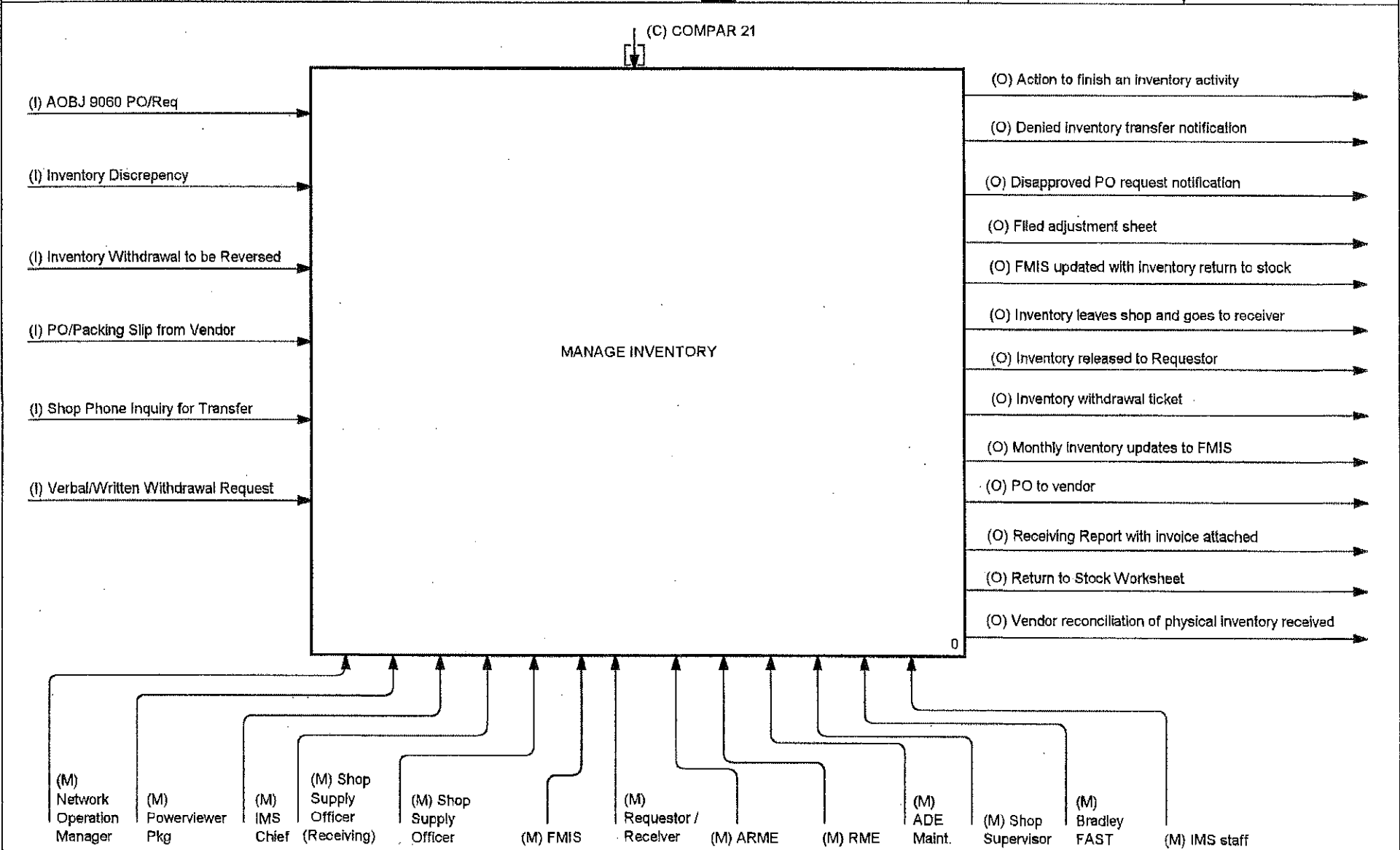
### **Activity Box**

Activity boxes represent functions, operations, processes, and transformations. An activity describes what happens in a particular environment. It transforms or processes an input and produces one or more recognizable results. Activities are performed by people, machine, computer systems, etc.

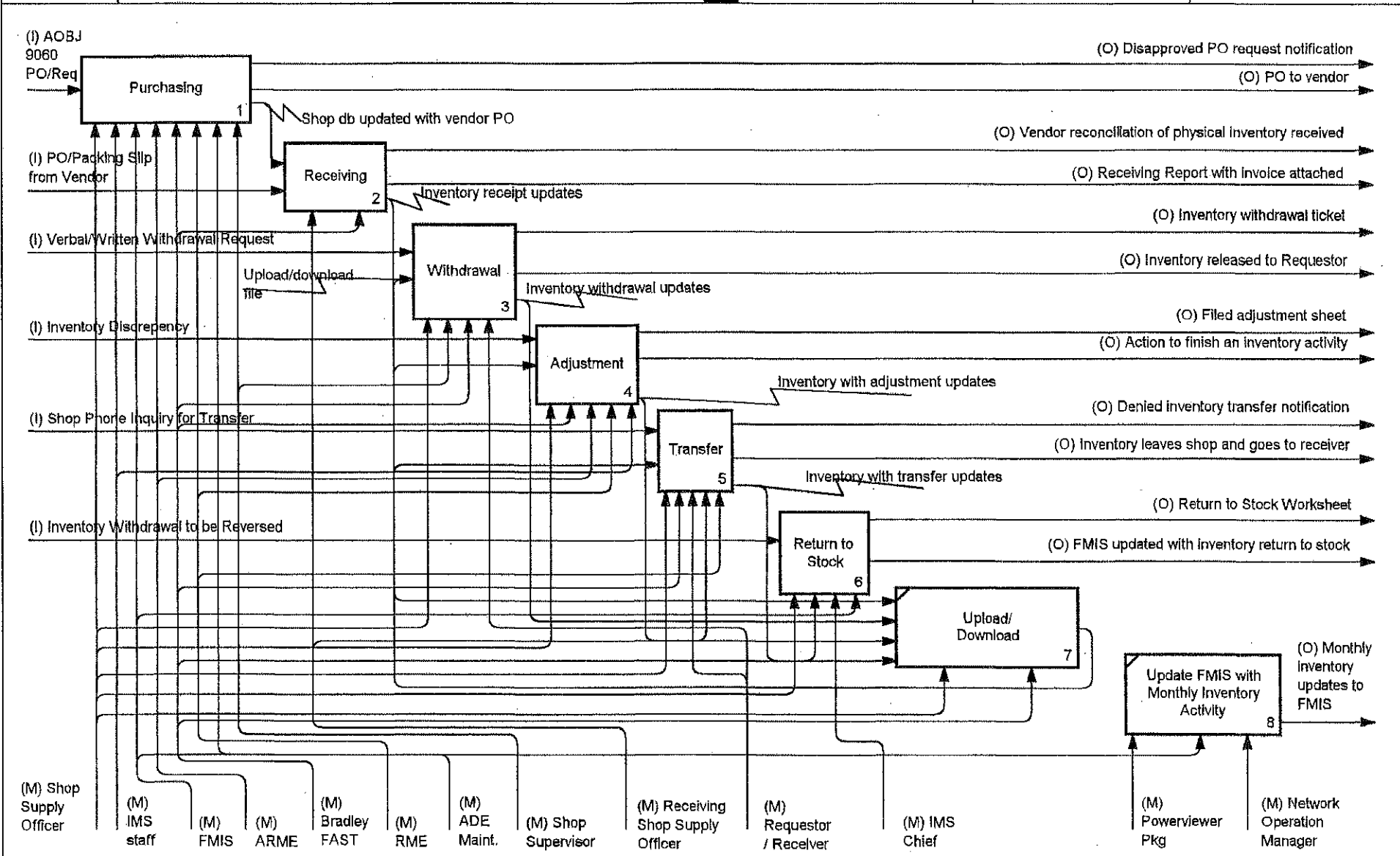
### **Glossary of Terms**

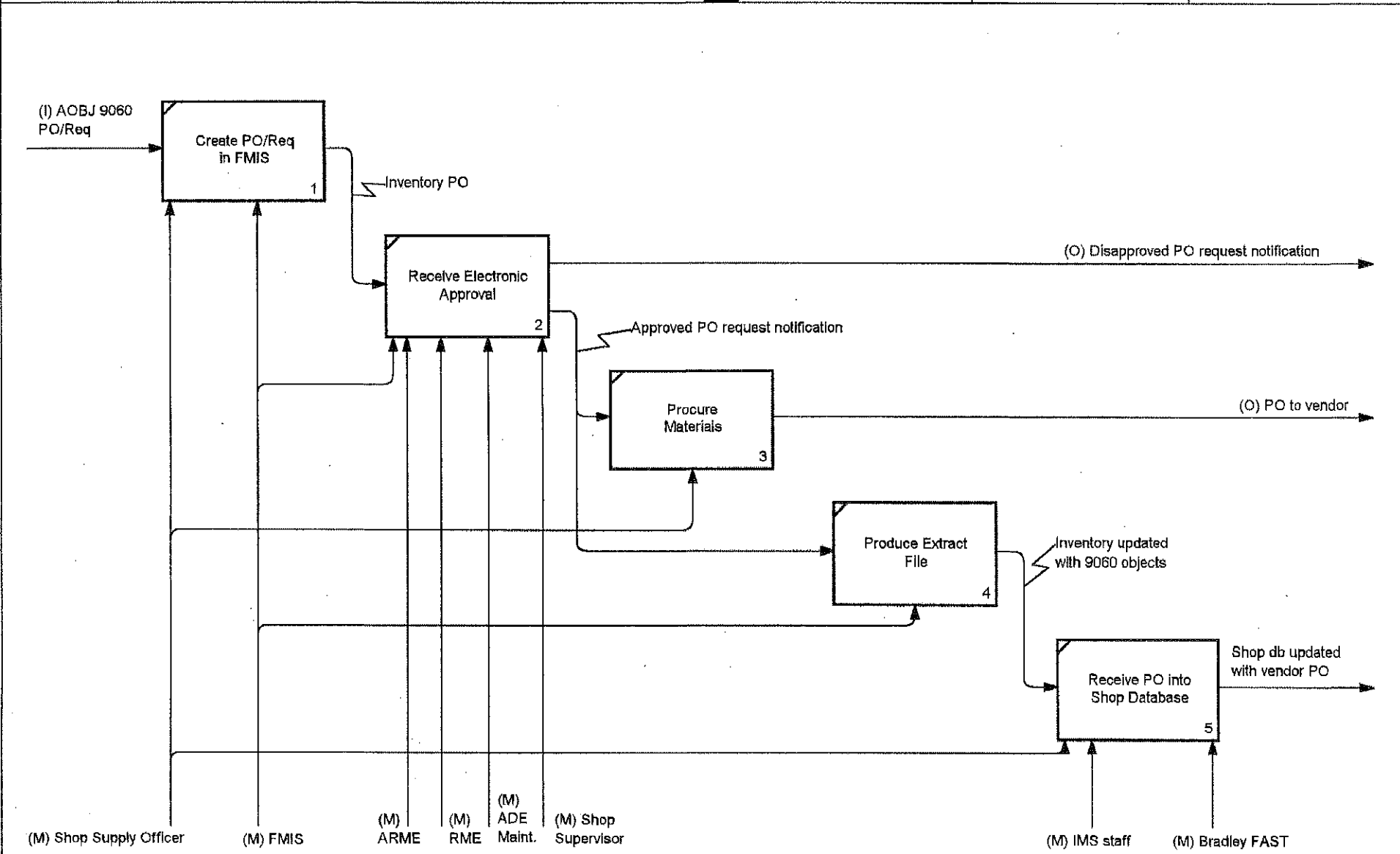
The Glossary of Terms is used to augment the IDEF0 Process Model and contains the name and definition of the input, output control and mechanism arrows.

USED AT:	AUTHOR:	DATE: 9 Jan. 1998	WORKING	READER	DATE	CONTEXT <b>NONE</b>
	PROJECT: SHA AS-IS Inventory System	REV: 27 Jan. 1998	DRAFT			
			RECOMMENDED			
			PUBLICATION			
NOTES: 1 2 3 4 5 6 7 8 9 10						



NODE: <b>A-0</b>	TITLE: <b>MANAGE INVENTORY</b>	NUMBER:
------------------	--------------------------------	---------





**Activity Name:** Purchasing  
**Activity Number:** A1  
**Activity Description:** Purchasing consists of :

- Create PO/Req in FMIS
- Receive Electronic Approval
- Procure Materials
- Produce Extract File
- Receive PO into Shop Database

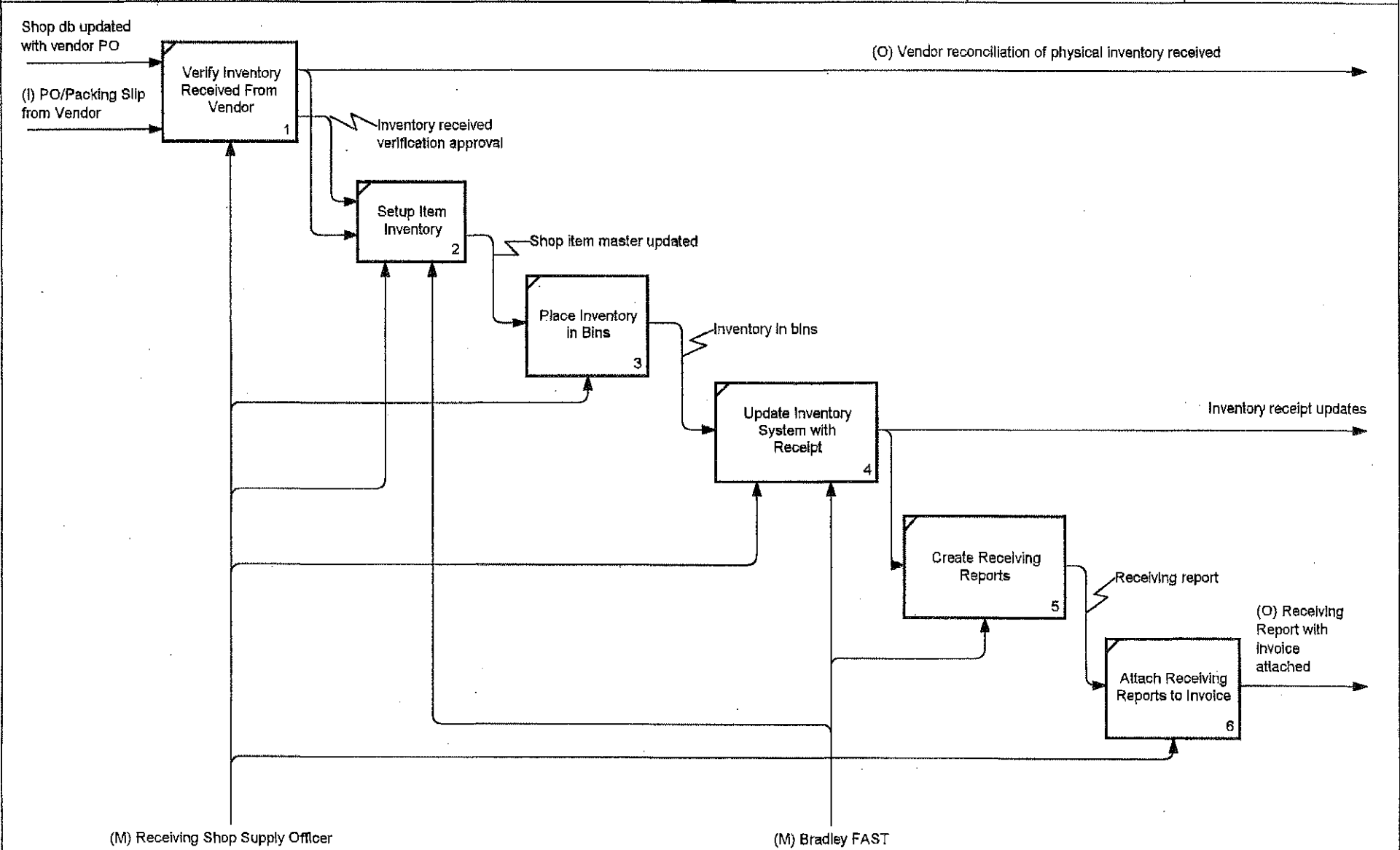
Create PO/ Req. In FMIS – The entering of an inventory purchase order request into the FMIS system. This is the point where the accounting information is initially recorded. In order for a PO to pass to the inventory system it must contain the following: Agency object = 9060, stock number must have S prefixes and index numbers must be for valid inventory locations.

Receive Electronic Approval – In FMIS, the PO awaiting approval is electronically approved and posted. Posted PO are available for extract from FMIS. Note: PO may not be extracted unless approved and posted.

Procure Materials – Shop supply officer looks at FMIS for approval/receive verbal approval and issues PO to vendor or physically procures material.

Produce Extract File – KPMG runs a nightly batch program to the PO extract file. The next day, IMS FTPs the file to the Bradley FAST central database. An export file is created and subsequently downloaded to the shops. In addition, similar extract files are created for charge codes and commodity codes. They also are downloaded to the shops via an extract file. Each shop will receive only data specific for that shop.

Recieve PO Into Shop Database – The shop supply officer does an upload download (takes shop information, sends it to the central database, and takes the central database information and sends it to the shops), then runs SQL runner which will take the information from the central database and physically update the shop database.





**Activity Name:** Receiving  
**Activity Number:** A2  
**Activity Description:** Receiving consists of:

- **Verify Inventory Received From Vendor**
- **Setup Inventory**
- **Place Inventory in Bins**
- **Update Inventory System with Receipt**
- **Create Receiving Reports**
- **Attach Receiving Reports to Invoice**

Verify Inventory received from Vendor – the vendor arrives with the inventory, the inventory is then unloaded to the stock area, and signed for. A physical count is then taken against the invoice or packing slip.

Setup Inventory- When a shop receives a new sku , the shop must go to the setup shop item window in Bradley FAST and a stock code verification is made against the Bradley FAST master stock table, additional data is requested such as lead time, min/max, low stock, purge and the item is added to the shop item setup table.

Place Inventory Into Bins – The inventory is then physically placed into bins.

Update Inventory System with Receipt – The shop supply officer goes to Bradley FAST pulls up the purchasing application screen and has the option of choosing PO list or go to PO number. The shop supply officer then goes to the receipt screen and enters quantity received by line item listing stock location, comments, date received and whom received by.

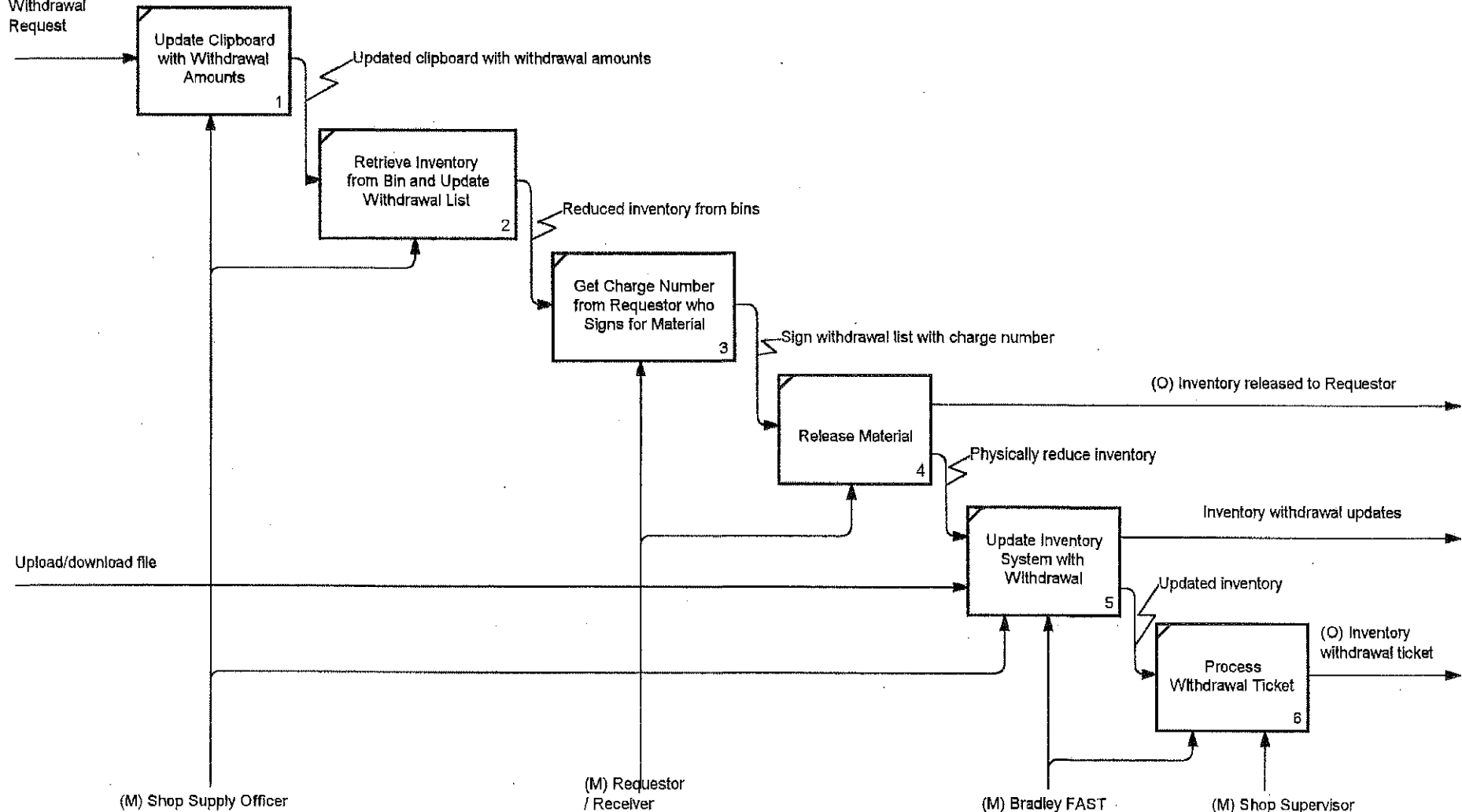
Issue: - 1. POs are added to the list but never deleted.  
2. The PO status is not displayed. The system needs to show more accurate PO status such as open, partial receipt, and closed etc.

Create Receiving Reports – Bradley FAST produces receiving reports.

Attach Receiving Reports to Invoice – Receiving reports are attached to invoices and sent to Finance. Finance makes the data entry to update FMIS with inventory update.

Issue: - There is no electronic feedback loop to FMIS. Finance wants a three way match in FMIS and for FMIS to identify and alert Bradley of discrepancies in cost.

(I) Verbal/Written  
Withdrawal  
Request



**Activity Name:** Withdrawal  
**Activity Number:** A3  
**Activity Description:** Withdrawal consists of:

- Update Clipboard with Withdrawal Amounts
- Retrieve Inventory from Bin and Update Withdrawal List
- Get Charge Number from Requestor who Signs for Material
- Release Material
- Update Inventory System with Withdrawal
- Process Withdrawal Ticket

Update Clipboard With Withdrawal Amounts – When the team leader or shop supervisor comes to the supply officer with a verbal or written request for an inventory item, the supply officer updates the clipboard (withdrawal sheet).

Retrieve Inventory From Bin and Update Withdrawal List- The supply officer goes to the bin location, ascertains the item, and updates the clipboard (withdrawal sheet).

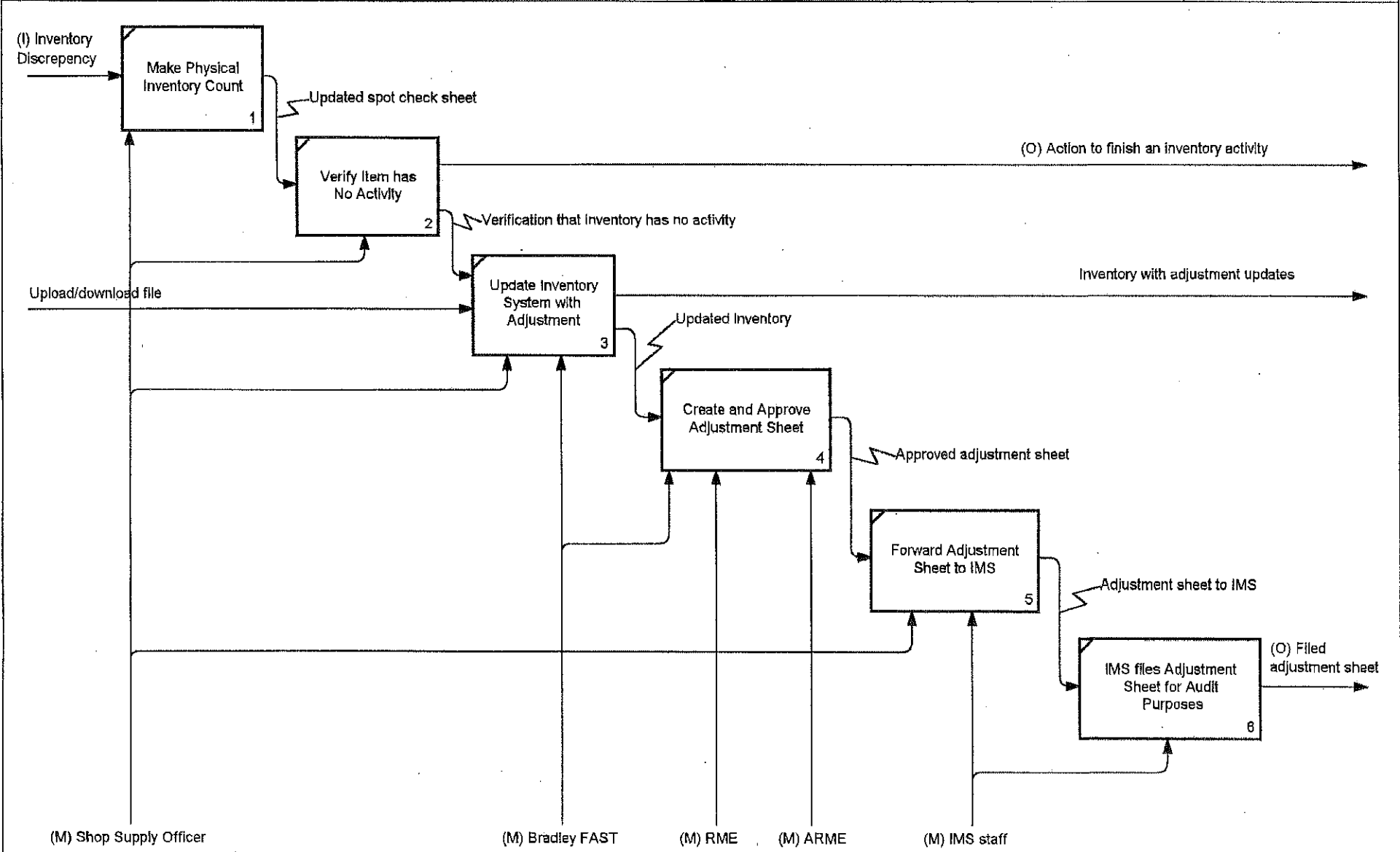
Get Charge Number from Requestor who Signs for Material- The requestor provides the supply officer with a charge number. The requestor then signs for the material.

Release Material- The inventory is then released to the requestor.

Update Inventory System with Withdrawal – The supply officer uses the clipboard withdrawal information to post withdrawals in Bradley FAST.

- Issue: - 1. On occasion, charge numbers valid in FMIS have failed to download into Bradley FAST.  
2. After withdrawals are closed, committed quantities remain and do not decrement the onhand.  
3. Bradley FAST allows negative committed quantities to occur.

Process Withdrawal Ticket – The supply officer will close and print the withdrawal ticket, obtain a signature from the requestor/approved authority, and file a copy of the withdrawal ticket in the shop file.



**Activity Name:** Adjustment  
**Activity Number:** A4  
**Activity Description:** Adjustment consists of:

- Make Physical Inventory Count
- Verify Item has No Activity
- Update Inventory System with Adjustment
- Create and Approve Adjustment Sheet
- Forward Adjustment Sheet to IMS
- IMS files Adjustment Sheet for Audit Purposes

Issue:

1. The Bradley FAST inventory receiving function is not working. SHA is using the adjustment process to receive.
2. Inventory does not belong to District offices. As a result, District PO are placed from the shop.

Make Physical Inventory Count- The shop supply officer assures that all the products are in the proper location. The shop supply officer selects items at random and performs a physical count. The results are recorded on a spot check sheet/physical inventories work sheet produced from Bradley FAST.

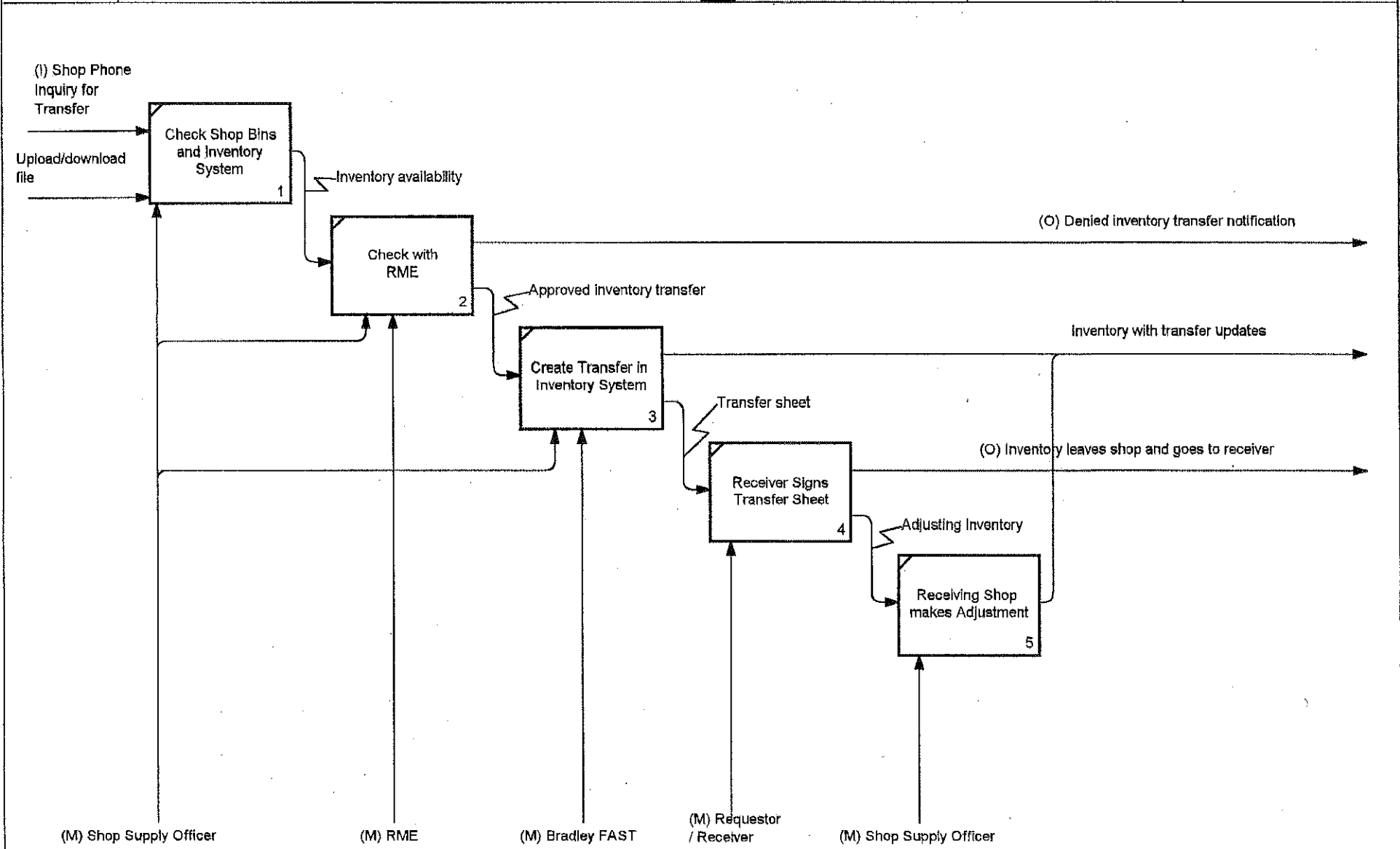
Verify Item has No Activity- The shop supply officer verifies that receipts, withdrawals, transfers that are to be applied to the stock number has applied. If there are outstanding activities, the outstanding activity is completed, otherwise the system is updated with the adjustment.

Update Inventory System with Adjustment- The shop supply officer uses the Bradley FAST adjustment screen and updates the shop database with the adjustment.

Create and Approve Adjustment Sheet- After the adjustment is made in Bradley FAST, the shop supply officer verifies the count balance on hand using the item inquiry screen. This must then be approved by the RME or ARME on a daily operation. During the year end physical inventory, the adjustment sheet must also be approved by the District ADE.

Forward Adjustment Sheet to IMS- The shop supply officer forwards the adjustment sheet to the IMS staff via interoffice mail.

IMS files Adjustment Sheet for Audit Purposes- IMS staff segregates adjustment and file for audit purposes.



**Activity Name:** Transfer  
**Activity Number :** A5  
**Activity Description:** Transfer consists of:

- Check Shop Bins and Inventory System
- Check with RME
- Create Transfer in Inventory System
- Receiver Signs Transfer Sheet
- Receiving Shop makes Adjustment

Check Shop Bins and Inventory System- The shop supply officer goes to the bins and physically verifies the quantity onhand.

Check with RME- The shop supply officer verbally contacts the RME. The RME will either verbal approve or deny the transfer.

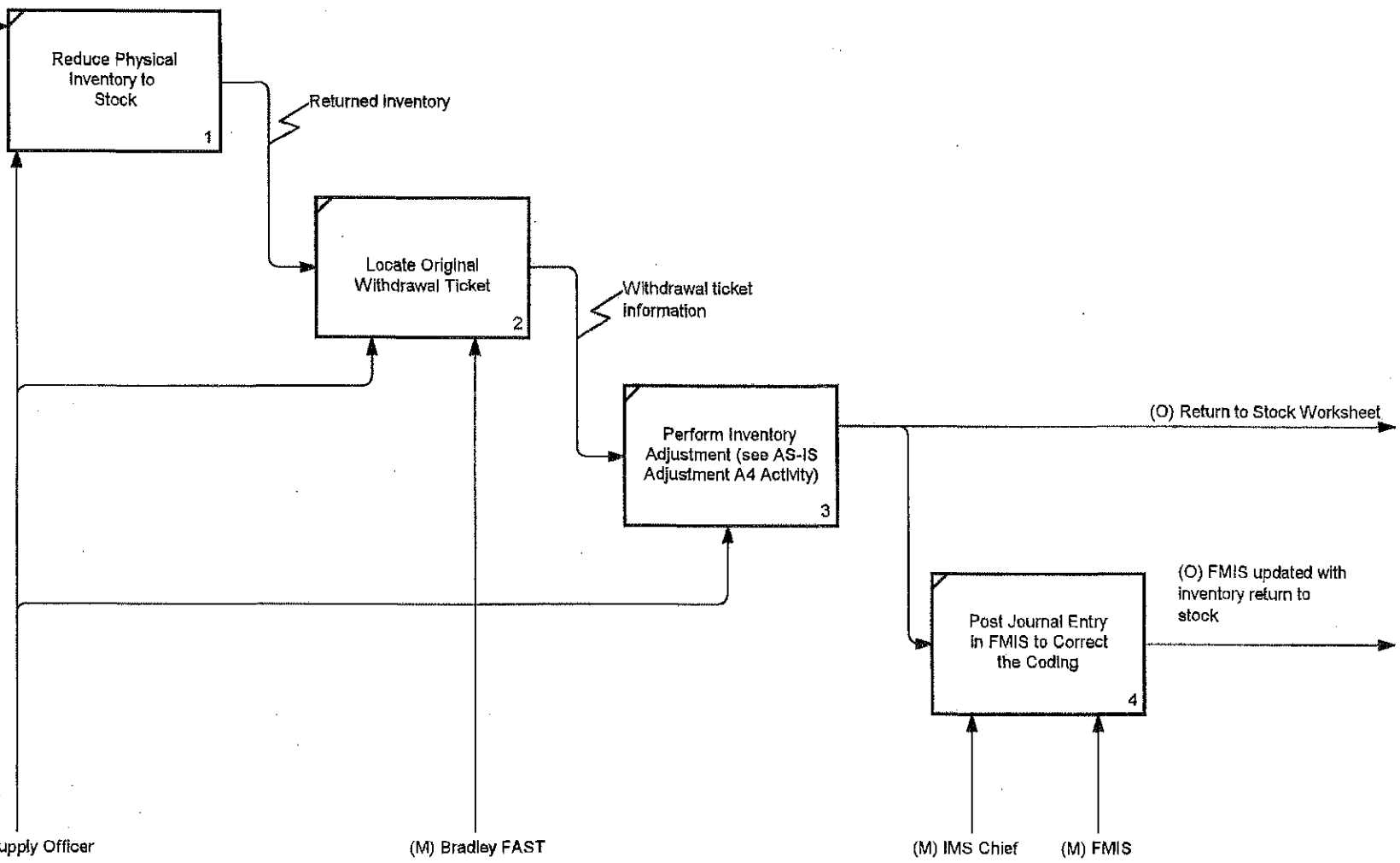
Create Transfer in Inventory System- The shop supply officer uses the Bradley FAST transfer window which simulates the use of applying a withdrawal ticket to the shop.

Receiver Signs Transfer Sheet- A copy of a signed transfer ticket and the material is given to the receiver by the shop supply officer.

Receiving Shop makes Adjustment- The receiving shop supply officer goes to the Bradley FAST adjustment window and adjusts the inventory to reflect the transfer amount.

- Issue:
1. Whatever FMIS is getting a any or all of the transaction data between the two shops.
  2. The receiving shop is unable to receive the transfer through the Bradley FAST transfer activity. Currently the receiving shop is doing an adjustment activity in lieu of a transfer activity.

(I) Inventory Withdrawal to be Reversed





**Activity Name:** Return to Stock  
**Activity Number:** A6  
**Activity Description:** Return to Stock consists of:

- Return Physical Inventory to Stock
- Locate Original Withdraw Ticket
- Perform Inventory Adjustment
- Post Journal Entry in FMIS to Correct the Coding

**NOTE:** Current process is not working in Bradley FAST. The shop is making the adjustment

Return Physical Inventory to Stock- The shop supply officer finds the original bin location and physically put the inventory back in the storage location.

Locate Original Withdrawal Ticket- The shop supply officer locate the original withdrawal ticket.

Perform Inventory Adjustment- The shop supply officer performs an inventory adjustment and provides the IMS chief with a return to stock worksheet.

Post Journal Entry in FMIS to Correct the Coding- Once the IMS chief receives the return to stock worksheet, the IMS chief makes an adjustment journal entry to reverse the coding related to the original withdrawal.

**Activity Name:** Upload Download Process  
**Activity Number:** A7  
**Activity Description:** Upload Download Process

Upload Download Process from the Shop Level

1. Each shop has a shop.log file which lists all transactions since the last file was created.
2. When the shop supply officer creates the extract file, Bradley FAST renames the shop.log file a text file (e.g. todaysdate.txt) and deletes the shop.log file.
3. Steps 1 & 2 should occur on a daily basis. Issue: Some shops do not perform this process on a daily basis in which case the shop.log file is appended to until the shop supply officer creates the extract file.
4. After the shop extract file is created, a batch process connects the shop extract file to the Bradley FAST central database server, grabs the extract shop.log file for export, and places the shop.log file on a que for the server.
5. A comparison is then made between the files generated from the Bradley FAST central database and the shop backup directory. If a discrepancy is found, the file is transferred to the shop export directory.
6. The next time the shop logs in, an import directory script is run which automatically updates the inventory database.

Upload Download Process from the Central Level

1. When central logs into Bradley FAST, central is given the option of running a script file when Bradley FAST has shop files waiting to be updated from the shop daily database to the central database.
2. The IMS Chief logs into FMIS and transfers the following files from FMIS to Bradley FAST:
  - CH\_CODE.TXT - charge code file
  - COMMODITY\_TXT - stock number file
  - POFILE.TXT - purchase order file
3. The above three files are downloaded to the local hard drive, placed in its own directory, and renamed based on the date of the download. Bradley FAST takes the text files and turn them into SQL statements which are written to the shop.log file. This file will contain new stock numbers, charge codes and purchase orders.
4. An error file is produced for wrongly coded items. However, in many cases, the entries in the error file are correct.

Issue: Purchase Order changes are not coming down from FMIS and updating Bradley FAST.

**Activity Name:**            **Update FMIS with Monthly Inventory Activity**  
**Activity Number:**        **A8**  
**Activity Description:**    **Update FMIS with Monthly Inventory Activity**

Update FMIS with Monthly Inventory Activity- On a monthly basis the network operation manager extracts transaction data from the Bradley FAST Central database to FMIS using Powersoft's Powerviewer Version 3.0 package.

This transfer includes withdrawals, adjustments, and transfers (?), since the last flagged update. The data fields and its associated Bradley FAST tables are:

<u>DATA FIELD</u>	<u>TABLE</u>
SHOP_NO	MDWDITEM
STOCK_NO	MDWDITEM
QTY_DISBURSED	MDWDREC
UNIT_PRICE	MDRECEIPT
PROJECT	MDWDITEM
PCA	MDWDITEM
PROPERTY_NO	MDWDITEM
AGENCY_OBJECT	MDWDITEM
AGENCY_1	MDWDITEM
AGENCY_2	MDWDITEM
AGENCY_3	MDWDITEM
DISTMEMO	MDWDITEM
CHRG_INDEX	MDWDITEM
WITHDRAW_DATE	MDWDHEAD
WITHDRAW_NO	MDWDHEAD
SENT_TO_FMIS	MDWDITEM

After the file is separated, the withdrawal program flags all existing data so that duplicates are not created in the next extract. This file is then transferred to a DB3 file. The Finance System Support Manager takes the DB3 file and examines it to ensure all fields are filled in. The IMS Chief provides missing file information. The file is then formatted to FMIS specifications by the Finance System Support Manager and uploaded to FMIS as a journal entry. At this point, the shop budgets are impacted.

Issue:

A Bradley FAST extraction file should have automated the above steps. However, this is currently not working.

**STATE HIGHWAY ADMINISTRATION**  
**MANAGE INVENTORY ACTIVITY**  
**AS-IS IDEF0 PROCESS MODEL**  
**GLOSSARY OF TERMS**

**Input**

1. AOBJ 9060 PO/Req- The essential financial coding for inventory items.
2. Inventory Discrepancy- Difference in physical count (quantity onhand) versus perpetual count.
3. Inventory Withdrawal to be Reserved- Verbal request from field mechanic to return an item to stock.
4. PO/Packing Slip from Vendor- Verification of quantity and items shipped by vendor for auditing purposes.
5. Shop Phone Inquiry for Transfer- Item description, manufacture part number, quantity requested.
6. Verbal/Written Withdrawal Request- Nonstandardized; item description, index number, PCA or charge number, stock number, unit of issue, quantity, requestor signature.

**Constraint:**

1. COMAR 21 – Statewide procurement regulation for purchasing.

**Output**

1. Denied Inventory Transfer Notification- A verbal notification to a requestor from the SHOP RME denying an inventory transfer request.
2. Disapproved PO Request Notification- An electronic notification on a FMIS screen indicating the disapproval of a FMIS purchase order.
3. Filed Adjustment Sheet- An adjustment sheet that contains the following fields: Shop Index, commodity code, description, unit of measure, objective number, PCA, bin location, unit cost, physical count, stock status balance, difference reason code.

4. FMIS Updated with Inventory Return to Stock- FMIS journal entry, charge code, agency object code, index, dollar amount.
5. Inventory Received Verification Approval- Signature on delivery receipt.
6. Inventory Stock Number Receipt Updates- The following fields are updated when an inventory is received: quantity onhand, unit price, bin location, date received using a FIFO method against Bradley FAST.
7. Inventory with Withdrawal Ticket- The following fields pertain to the inventory withdrawal ticket: shop index, commodity code, description, bin location, unit of measure, quantity issued, extended cost (qty X unit cost), PCA, Agency object, property, project, multipurpose code, agency 1, agency 2, agency 3, entered by, approved by, received by.
8. PO to Vendor- The purchase order to vendor contains the following information: index, order number, purchase order creation date, vendor name, delivery date, buyer code, purchase order status, line number, commodity code, quantity ordered, unit cost, unit measure.
9. Receiving Report with Invoice Attached- The receiving report contains the following information: vendor, purchase order, shop index, commodity code, description, unit of measure, quantity ordered, quantity received, date received, objective number, signature of employee receiving materials.
10. Return to Stock Worksheet- The return to stock worksheet contains the following information: adjustment number, item, number of units, unit cost, extended cost, index, PCA/Project Number, AOBJ, shop supply officer, shop index, date of return to stock.
11. Shop Database Update with Vendor PO- field extracted by KPMG, necessary fields put in extract file for upload/download process. The following data is placed in the purchase order file: index, order number, purchase order creation date, vendor name, delivery date, buyer code, purchase order status, line number, commodity code, quantity ordered, unit cost, unit of measure. The following data is placed in the mdcodes file: screen number, agency code, project number/PCA/Charge number/property number, project description, project description, project status (A = active, I = inactive), project inception date, project close date, user\_code (the user\_code = FMIS). The following data is placed in the commodity file: stock number, description, unit of measure, user code, date/time, active status.
12. Transfer Sheet – This sheet contains the information which shows the decrement of the qty onhand at one shop and the increment of the qty onhand at another shop. Currently, the Bradley FAST system is not able to produce this sheet. The transfer sheet will be further explored in the TO-BE section of the document.
13. Vendor Reconciliation of Physical inventory received- Verbal negotiation between receiving shop supply officer and vendor; purchase order is adjusted as a result.

### **Mechanisms**

1. ADE Maintenance- Assistant District Engineer responsible for the District Maintenance activities. RMEs report to ADE.
2. ARME- Assistant Resident Maintenance Engineer.
3. Bradley FAST- Current SHA material and supply inventory system.
4. FMIS- MDOT Financial Management information mainframe system.
5. IMS Chief- The section chief for the inventory management section.
6. IMS Staff- SHA OFIT section that provides oversight and support over the inventory function.
7. Network Operation Manager- The individual who manages SHA network.
8. Powerviewer Package- Powersoft's reporting software (Version 3.0).
9. Receiving Shop Supply Officer- Person responsible for receiving procurement and distribution of shop/location related activity.
10. Requestor/Receiver- An individual who requests the withdrawal of an inventory item.
11. RME- Resident Maintenance Engineer responsible for overall shops operations.
12. Shop Supervisor- Person responsible for overall shop functions in a non-maintenance shop.
13. Shop Supply Officer- Person responsible for procurement and distribution of shop/location related activities.

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**MANAGE INVENTORY  
WORK IN PROCESS**

**AS-IS IDEFO PROCESS MODEL**

**Prepared for:  
State Highway Administration  
(SHA)  
Publication: February 4, 1998**

**STATE HIGHWAY ADMINISTRATION**  
**MANAGE INVENTORY ACTIVITY – WORK IN PROCESS**  
**AS-IS IDEFO PROCESS MODEL**

**Introduction**

This document represents the MANAGE INVENTORY – WORK IN PROCESS AS-IS IDEFO process model for the State Highway Administration (SHA). Activities: A1 – Purchasing, A2 – Receiving, A3 – Withdrawal, A4 – Adjustment, A5 – Transfer, A6 – Return to Stock, A7 - Upload/Download, and A8 – Update FMIS with Monthly Inventory Activity are the same as the activities modeled in the SHA MANAGE INVENTORY document. As a result, these activities and their associated inputs, constraints, outputs, and mechanisms are not decomposed or defined in this writeup.

The model consists only of the MANAGE INVENTORY –WORK IN PROCESS AS-IS IDEFO process model with MANAGE INVENTORY – WORK IN PROCESS model definitions identified in the glossary of the document.

**Viewpoint**

The viewpoint is the point of view that is assumed when constructing the model. The SHA JAD 1 participants identified the viewpoint of the Manage Inventory AS-IS IDEFO State Highway Administration AS-IS MANAGE INVNTORY - WORK IN PROCESS activity to be that of the State Highway Administration Inventory Management Staff.

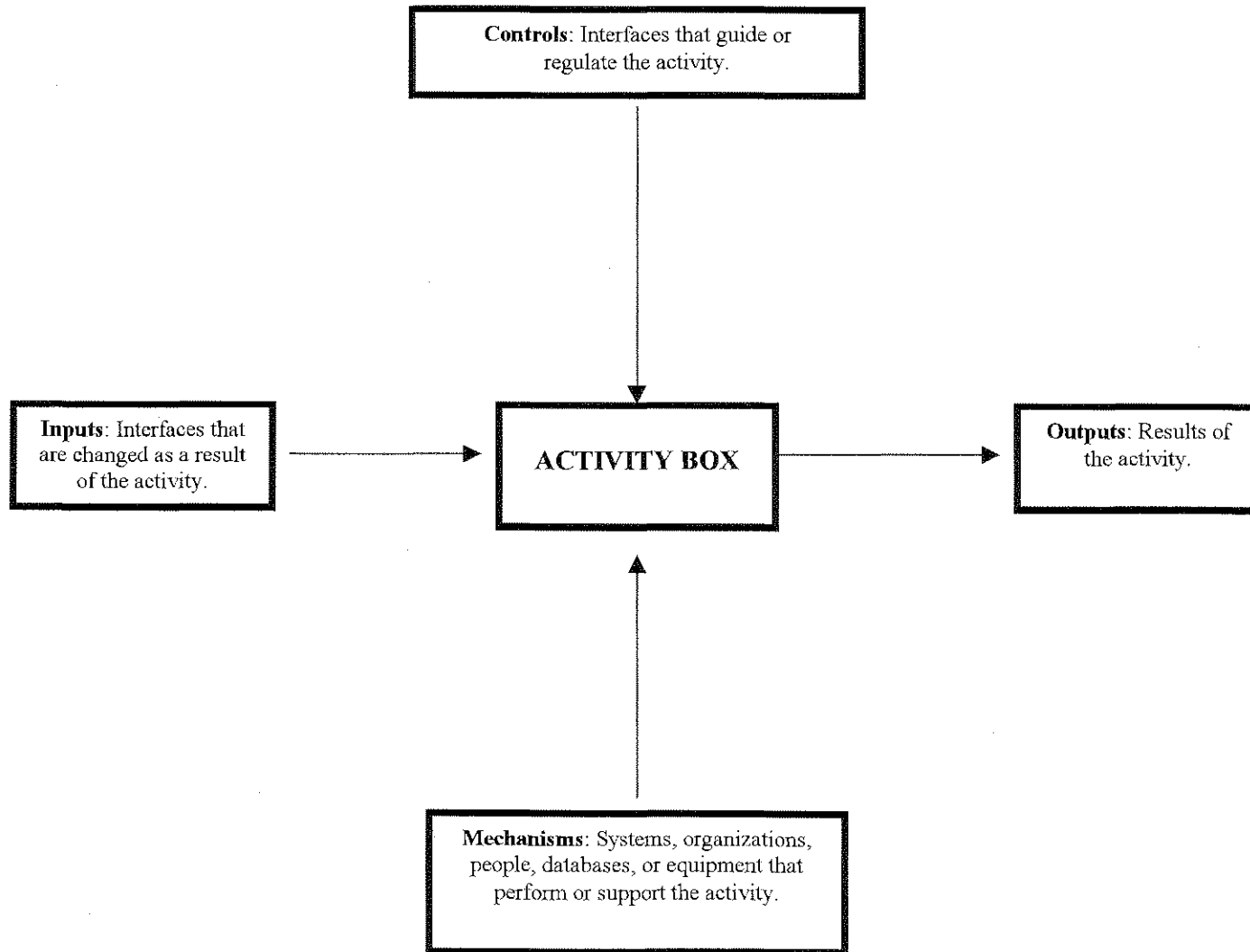
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- Provide day to day inventory functionality
- Be effective and efficient
- Eliminate the reentering of duplicate data
- Provide accurate inventory counts
- Provide user friendly reporting capability/outputs
- Have the ability to identify the level, mix, and proper inventory at the proper location
- Identify obsolete materials
- Provide the basis for the reorder report
- Provide the capability to record accounting and transfers to FMIS and other systems as identified
- Comply with internal controls such as security
- Provide real time inventory



## IDEF0 ACTIVITY CONVENTIONS



### **Context Diagram**

The context Diagram is established for the activity on the A-0 diagram. The context is the way in which the activity "Manage Inventory Program Activity" interfaces with the larger world.

### **Activity Box**

Activity boxes represent functions, operations, processes, and transformations. An activity describes what happens in a particular environment. It transforms or processes an input and activity produces one or more recognizable results. Activities are performed by people, machine, computer systems, etc.

### **Glossary of Terms**

The Glossary of Terms is used to augment the IDEF0 Process Model and contains the name and definition of the input, output control and mechanism arrows.

**The following activities are the same as the activities identified in the MANGE INVENTORY – AS-IS IDEF0 Process Model and are not defined in this document. See MANAGE INVENTORY – AS-IS IDEF0 Process Model for details on each of the activities identified below.**

**Activity Name:** Purchasing of Raw Materials  
**Activity Number:** A1  
**Activity Description:** Same as MANAGE INVENTORY – AS-IS IDEF0 Process Model (A1 – Purchasing).

**Activity Name:** Receiving of Raw Materials  
**Activity Number:** A2  
**Activity Description:** Same as MANAGE INVENTORY – AS-IS IDEF0 Process Model (A2 – Receiving).

**Activity Name:** Adjustment of Raw Materials & Finished Goods  
**Activity Number:** A4  
**Activity Description:** Same as MANAGE INVENTORY – AS-IS IDEF0 Process Model (A4 – Adjustment).

**Activity Name:** Transfer of Raw Materials & Finished Goods  
**Activity Number:** A5  
**Activity Description:** Same as MANAGE INVENTORY – AS-IS IDEF0 Process Model (A5 – Transfer).

**Activity Name:** Return to Stock of Finished Goods  
**Activity Number:** A6  
**Activity Description:** Same as MANAGE INVENTORY – AS-IS IDEF0 Process Model (A6 – Return to Stock).

**Activity Name:** Upload/Download  
**Activity Number:** A6  
**Activity Description:** Same as MANAGE INVENTORY – AS-IS IDEF0 Process Model (A6 – Upload/Download).

**Activity Name:** Update FMIS with Monthly Inventory Activity  
**Activity Number:** A8  
**Activity Description:** Same as MANAGE INVENTORY – AS-IS IDEF0 Process Model (A8 – Update FMIS with Monthly Inventory Activity).

**Activity Name:** Withdrawal of Raw Materials  
**Activity Number:** A3  
**Activity Description:** Withdrawal of Raw Material consists of:

- Update Clipboard with Withdrawal Amounts
- Retrieve Inventory from Bin and Update Withdrawal List
- Perform Weekly Computer Withdrawal Updates
- Combine Raw Materials to Make Finished Goods
- Make Finished Goods Entry in Bradley Fast

Update Clipboard with withdrawal - Same as MANAGE INVENTORY – AS-IS IDEF0 Process Model (A31 – Update Clipboard with Withdrawal Amounts).

Retrieve Inventory from Bin and Update Withdrawal List - Same as MANAGE INVENTORY – AS-IS IDEF0 Process Model (A32 – Retrieve Inventory from Bin and Update Withdrawal List).

Perform Weekly Computer Withdrawal Updates – The posting of withdrawals is based on the stock item usage. A raw material withdrawal entry is made in Bradley FAST into Work in Process.

Combine Raw Materials to Make Finished Goods – The raw materials that has been withdrawn is used to fabricate a sign or signs.

Make Finished Goods Entry in Bradley Fast – After a sign or signs have been fabricated, an entry is made in Bradley FAST to record the creation of finished goods inventory which will have a unique stock number. At this point, one of two scenarios may occur:

Scenario 1 – If the sign is custom ordered, the sign is immediately withdrawn from the finished goods and shipped to its destination.

Scenario 2 - If the sign is a stock item, the sign is placed in a bin based on its commodity code.

Issue:

1. Need to reduce Work in Process account for cost of finished goods in FMIS.
2. There should be a document trail for all finished goods entries.

**STATE HIGHWAY ADMINISTRATION**  
**MANAGE INVENTORY ACTIVITY – WORK IN PROCESS**  
**AS-IS IDEF0 PROCESS MODEL**  
**GLOSSARY OF TERMS FOR A3 – WITHDRAWAL OF RAW MATERIALS**

**Input**

1. Written Withdrawal Request – A written request to withdraw shop inventory.

**Constraint:**

1. COMAR 21 – Statewide procurement regulation for purchasing.

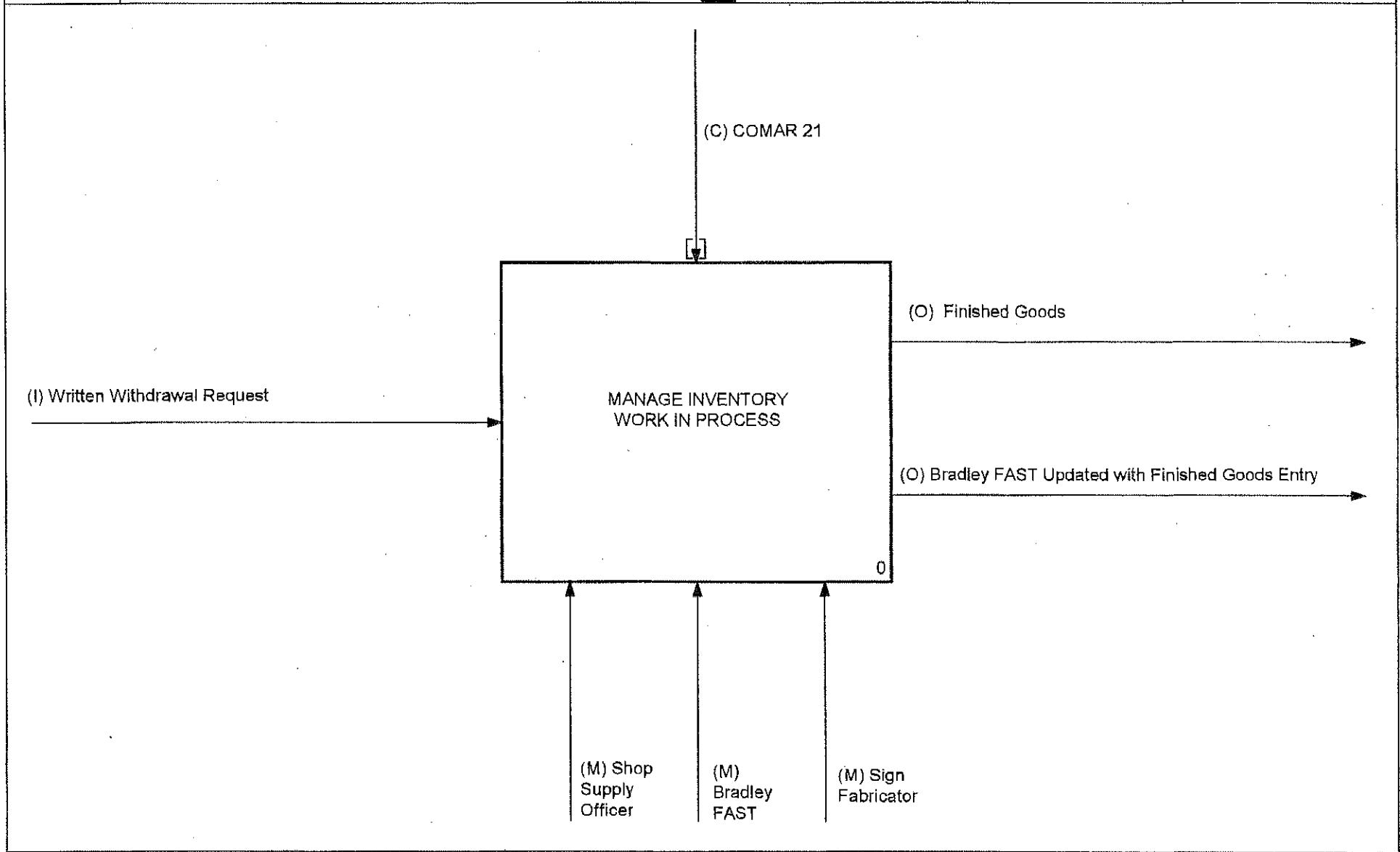
**Output**

1. Finished Goods – The signs that are fabricated from the Sign Shop.

**Mechanisms:**

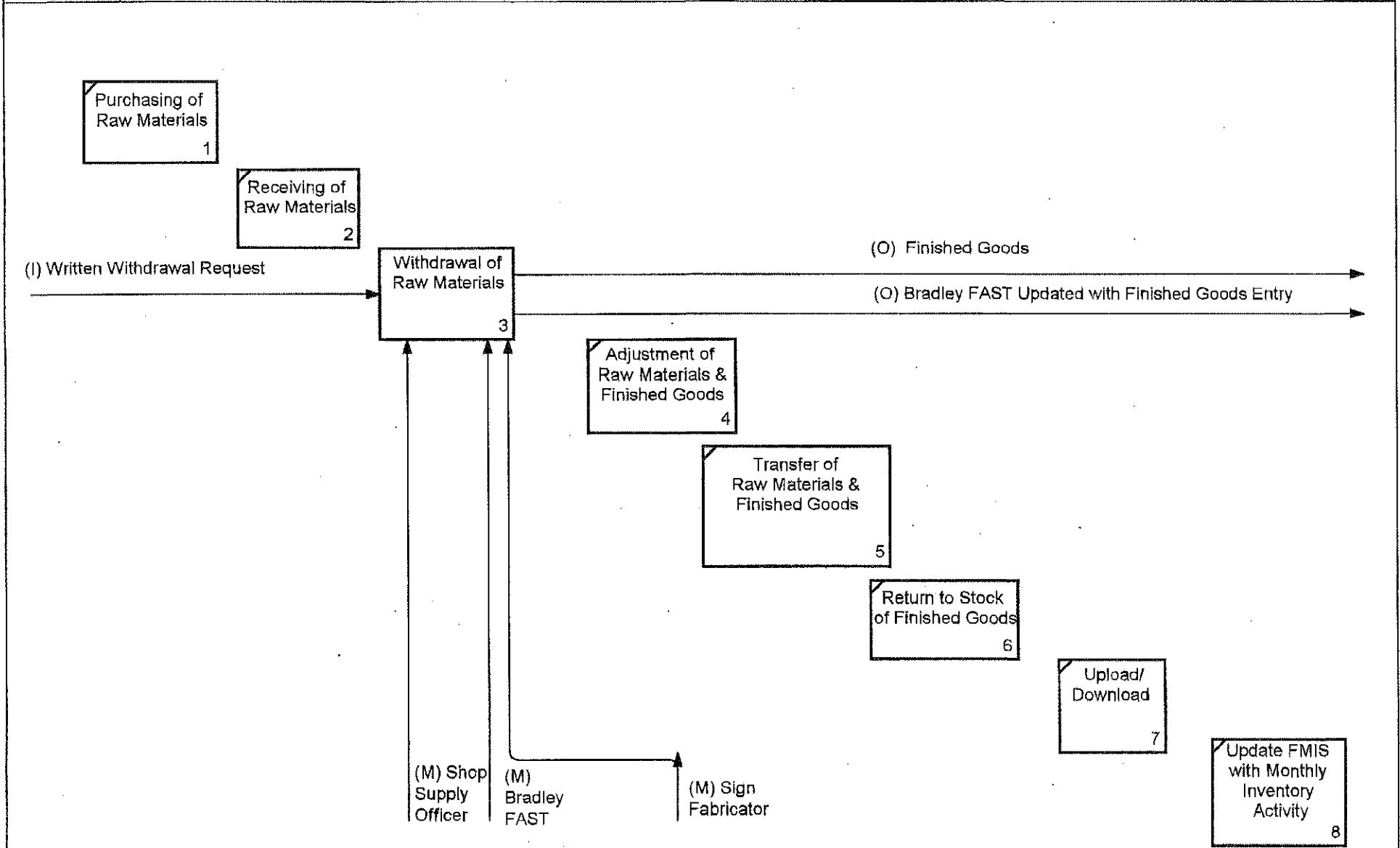
1. Sign Fabricator – Employees responsible for the making of the sign.
2. Shop Supply Officer – Person responsible for procurement and distribution of shop/location related activities.
3. Bradley FAST – The current SHA materials and supply inventory system.

USED AT:	AUTHOR:	DATE: 15 Jan. 1998	WORKING	READER	DATE	CONTEXT <b>NONE</b>
	PROJECT: SHA MANAGE INVENTORY - AS-IS WIP WITHDRAWAL	REV: 4 Feb. 1998	DRAFT			
			RECOMMENDED			
	NOTES: 1 2 3 4 5 6 7 8 9 10		PUBLICATION			



NODE: <b>A-0</b>	TITLE: <b>MANAGE INVENTORY WORK IN PROCESS</b>	NUMBER:
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USED AT:	AUTHOR:	DATE: 15 Jan. 1998	WORKING	READER	DATE	CONTEXT
	PROJECT: SHA MANAGE INVENTORY - AS-IS WIP WITHDRAWAL	REV: 15 Jan. 1998	DRAFT			TOP
			RECOMMENDED			
	NOTES: 1 2 3 4 5 6 7 8 9 10		PUBLICATION			

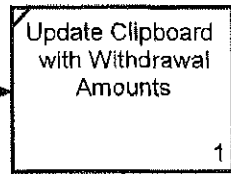


NODE: A0	TITLE: MANAGE INVENTORY WORK IN PROCESS	NUMBER:
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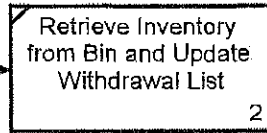


USED AT:	AUTHOR:	DATE: 15 Jan. 1998	WORKING	READER	DATE	CONTEX
	PROJECT: SHA MANAGE INVENTORY - AS-IS WIP WITHDRAWAL	REV: 4 Feb. 1998	DRAFT			A0
	NOTES: 1 2 3 4 5 6 7 8 9 10		RECOMMENDED			
			PUBLICATION			

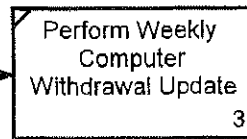
(I) Written  
Withdrawal  
Request



Updated clipboard with withdrawal amounts

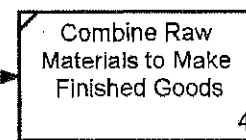


Reduced inventory from bins

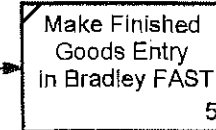


Inventory system updated with withdrawal updates

(O) Finished Goods



Finished Goods information



(O) Bradley FAST Updated with Finished Goods Entry

(M)  
Shop  
Supply  
Officer

(M)  
Bradley  
FAST

(M) Sign  
Fabricator

NODE: A3

TITLE: Withdrawal of Raw Materials

NUMBER:

FINAL COPY

# **MANAGE INVENTORY**

## **TO-BE IDEF0 PROCESS MODEL**

**Prepared for:**  
**State Highway Administration**  
**(SHA)**

**Publication: March 31, 1998**

## **MANAGE INVENTORY ACTIVITY** **TO-BE IDEFO PROCESS MODEL**

### **Introduction**

This document represents the TO-BE IDEFO process model for the State Highway Administration (SHA). The model consists of an IDEFO process model with process model definitions identified in the glossary of the document.

### **Viewpoint**

The viewpoint is the point of view that is assumed when constructing the model. Inventory Management Staff identified the viewpoint of the Manage Inventory Activity TO-BE IDEFO Process model to be that of the State Highway Administration Inventory Management Staff.

### **Purpose**

The purpose is the statement of why the model is being constructed. The purpose statement is a clear statement of what the model will be used to accomplish. Inventory management staff determined that the purpose of "Management Inventory Activity Program" is to produce the following management inventory activity program products for which the division is responsible:

- Day to day functionality
- Effective and efficient
- Eliminate data re-entering
- Accurate inventory counts
- User friendly reporting capability/outputs
- Ability to identify level, mix, proper inventory at proper location
- Identify overstock and obsolete materials
- BASIS for reorder report
- Ability to record accounting and transfer to FMIS and other systems as identified
- Complies with internal controls
- Real time inventory

### **Context Diagram**

The context Diagram is established for the activity on the A-0 diagram. The context is the way in which the activity “Manage Inventory” interfaces with the larger world.

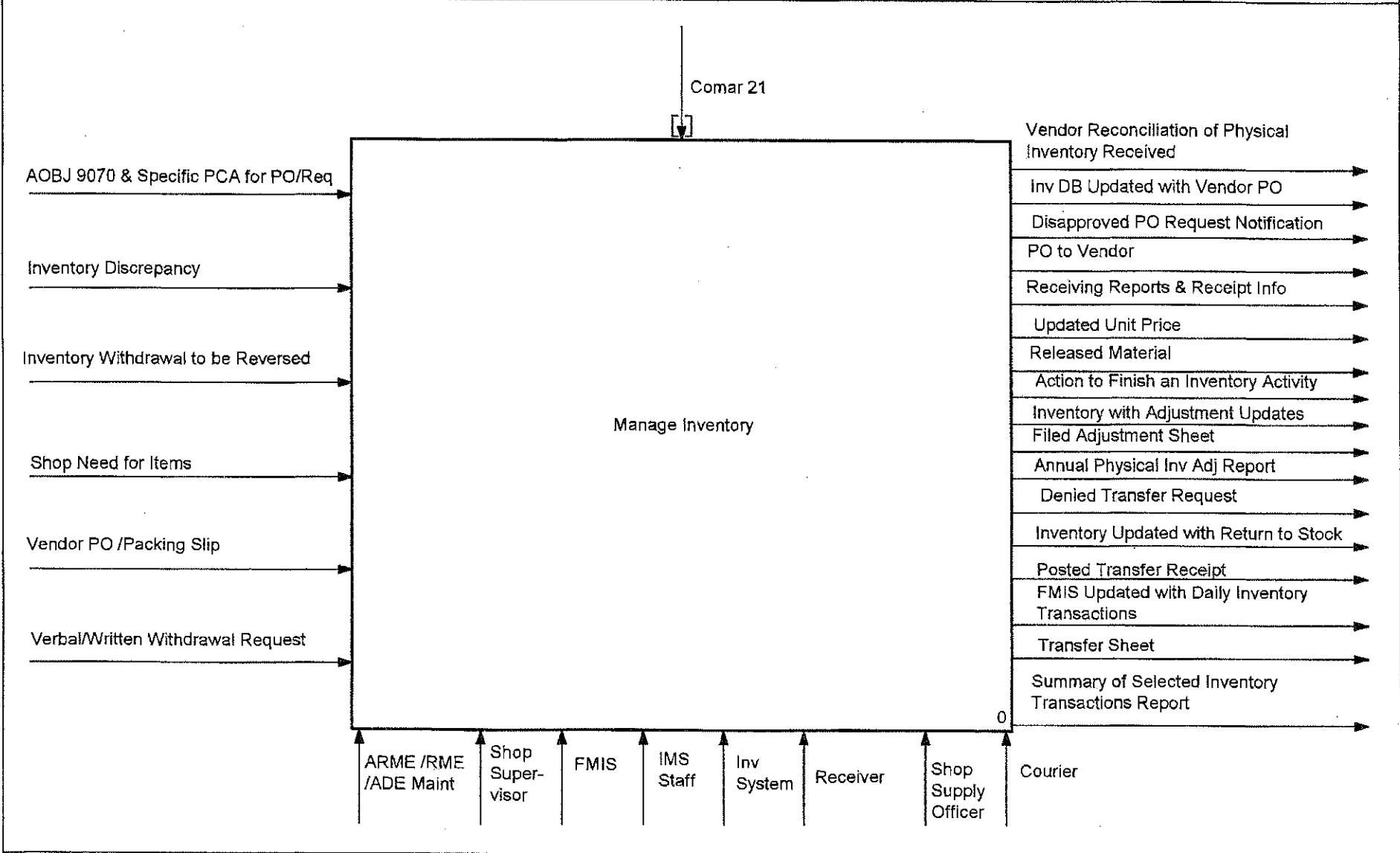
### **Activity Box**

Activity boxes represent activities which may be functions, operations, processes, and transformations. An activity describes what happens in a particular environment. An activity transforms or processes an input. An activity produces one or more recognizable results and is performed by people, machine, computer systems, etc.

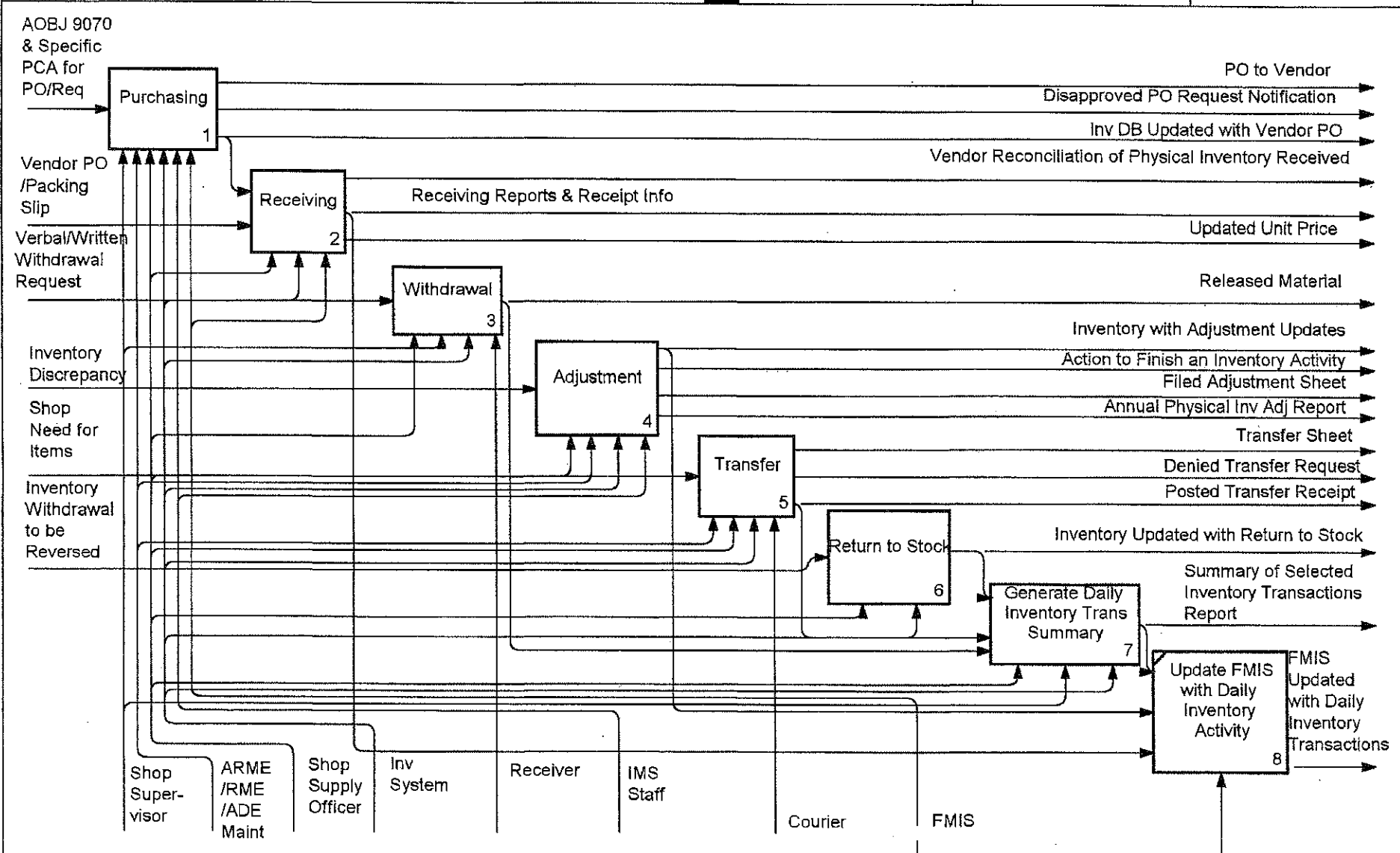
### **Glossary of Terms**

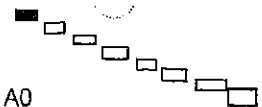
The Glossary of Terms is used to augment the IDEF0 Process Model and contains the name and definition of the input, output, control, and mechanism arrows.

USED AT:	AUTHOR:	DATE: 23 Feb. 1998	WORKING	READER	DATE	CONTEXT <b>NONE</b>
	PROJECT: SHA Manage Inventory - TO-BE	REV: 6 Mar. 1998	DRAFT			
			RECOMMENDED			
	NOTES: 1 2 3 4 5 6 7 8 9 10		PUBLICATION			

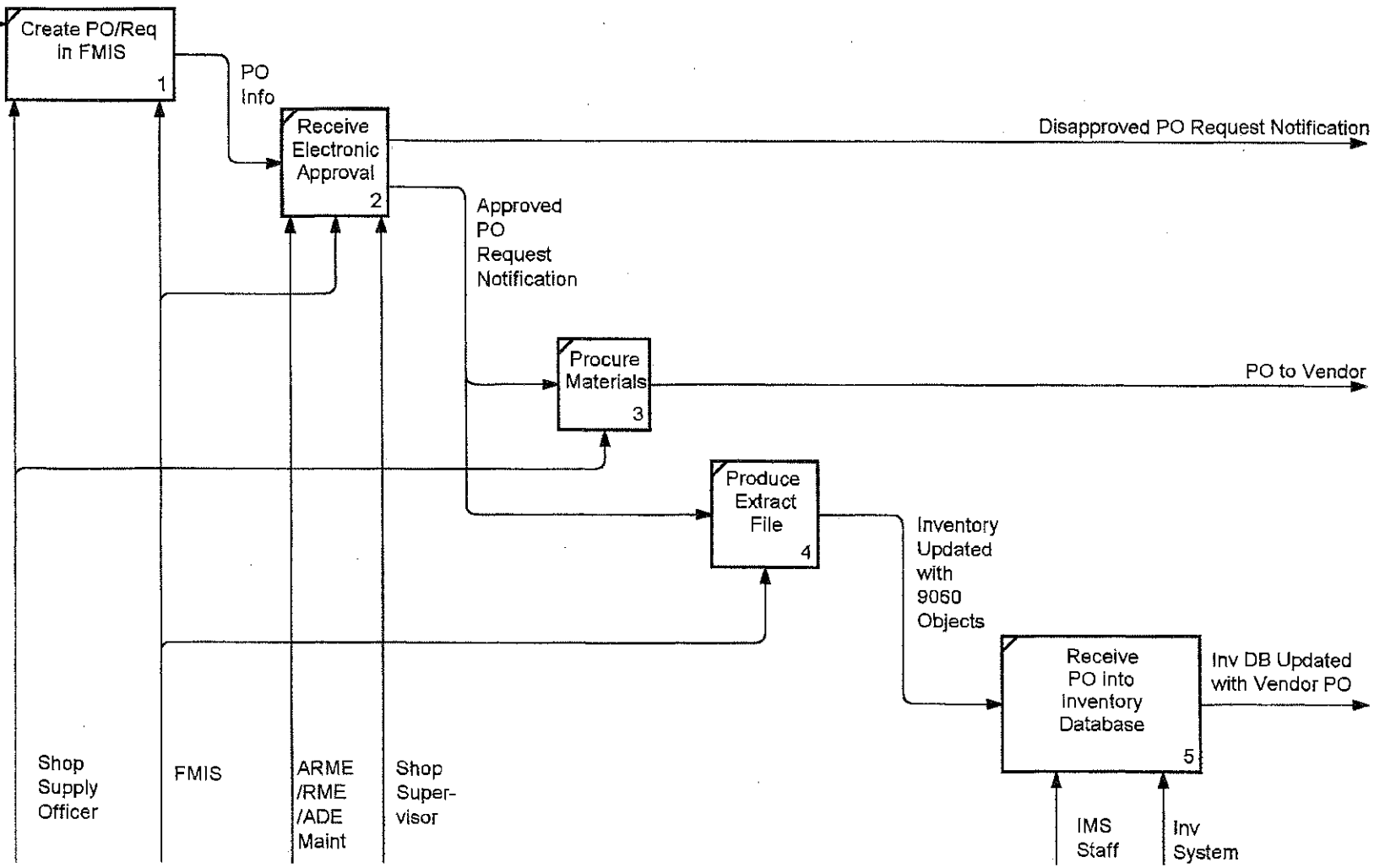


NODE: <b>A-0</b>	TITLE: <b>Manage Inventory</b>	NUMBER:
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USED AT:	AUTHOR:	DATE: 23 Feb. 1998	WORKING	READER	DATE	CONTEX  A0
	PROJECT: SHA Manage Inventory - TO-BE	REV: 25 Feb. 1998	DRAFT			
			RECOMMENDED			
			PUBLICATION			
NOTES: 1 2 3 4 5 6 7 8 9 10						

AOBJ 9070 &  
Specific PCA for  
PO/Req



NODE: A1	TITLE: Purchasing	NUMBER:
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**STATE HIGHWAY ADMINISTRATION**  
**MANAGE INVENTORY**  
**TO-BE IDEFO PROCESS MODEL**

**ACTIVITY DEFINITIONS**

Activity Name: Purchasing  
Activity Number: A1  
Activity Description: Purchasing consists of:

- A11 - Create PO/Req in FMIS
- A12 - Receive Electronic Approval
- A13 - Procure Materials
- A14 - Produce Extract File
- A15 - Receive PO into Inventory Database

A11 - Create P.O/Reg. In FMIS – The entering of an inventory purchase order request into the FMIS system. This is the point where the accounting information is initially recorded. In order for a P.O to pass to the inventory system it must contain the following: Agency object = 9060, stock number must have S prefixes and index numbers must be for valid inventory locations and appropriate inventory PCA. The shop location identifier should always equal the index. On reorders, the purchase order system should recommend vendors based on previous purchase orders.

FMIS PO Issue:

1. When creating a purchase order, SHA would like the ability to purchase by the manufacturer's part number.
2. PO changes are not being passed from FMIS to the inventory system. The KPMG file needs to be expanded to include change orders.

A12 - Receive Electronic Approval – In FMIS, the PO awaiting approval is electronically approved and posted. Posted PO are available for extract from FMIS. Note: POs may not be extracted unless approved and posted.

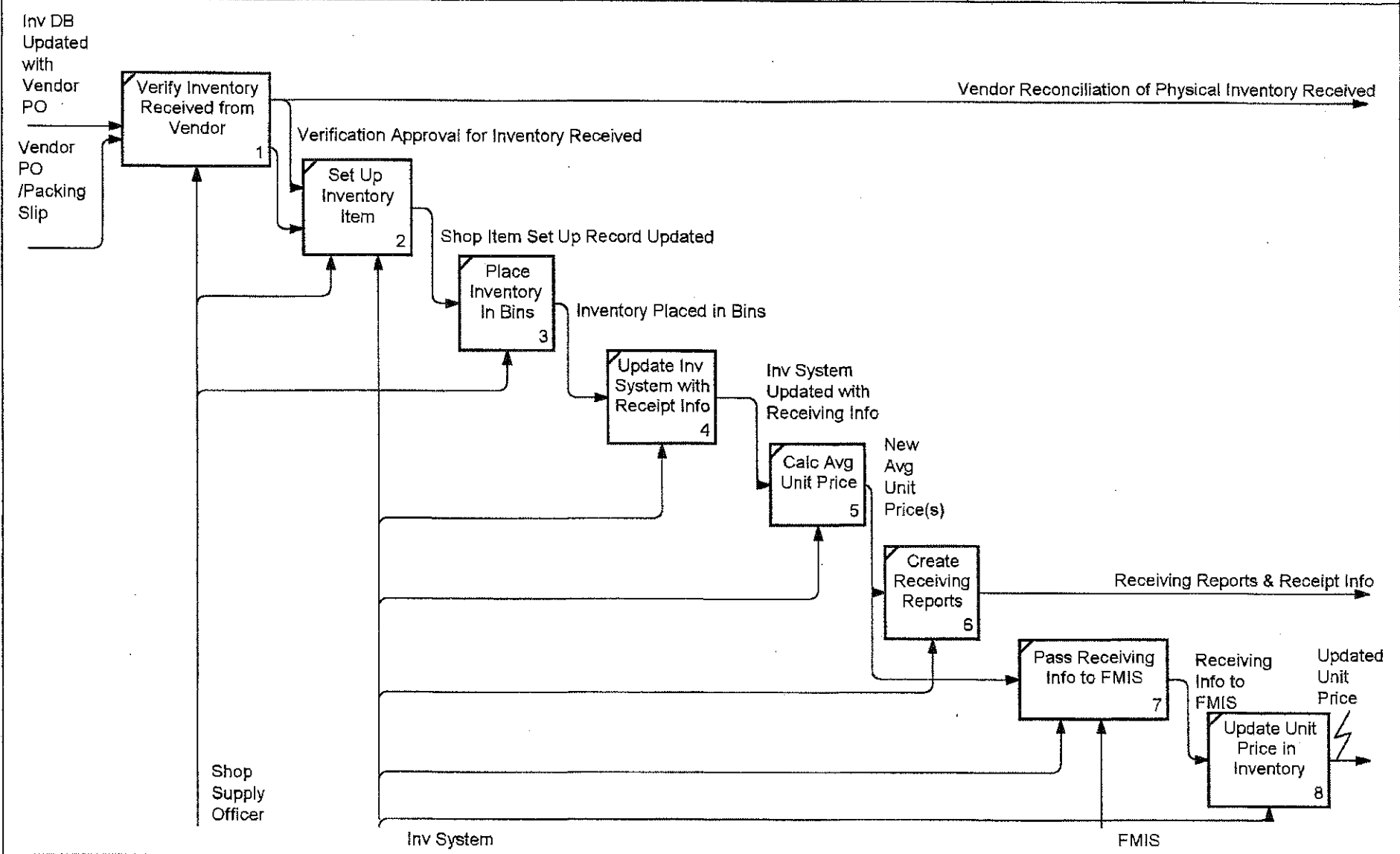
A13 - Procure Materials – Shop snply officer looks at FMIS for approval /receive verbal approval and issues PO to vendor or physically procures material.

A14 - Produce Extract File – KPMG runs nightly batch program to the PO extract file. The next day, IMS FTPs the file to the inventory system central database. An export file is created and subsequently downloaded to the shops. Each shop will receive only data specific for that shop. The following PO fields are passed: Index, Order No, PO Creation Date, Vendor Name, Delivery Date, Buyer-Emp-No, PO Status, Line No, Commodity Code, Quantity Ordered, Unit Cost, Unit of Measure, PO Initiator, PCA.

A15 - Receive P.O Into Inventory Database - PO information will be automatically extracted from FMIS and sent to the inventory database. Each shop will view only the open PO info specific to that shop with prompts to view partial PO info.



USED AT:	AUTHOR:	DATE: 23 Feb. 1998	WORKING	READER	DATE	CONTEXT
	PROJECT: SHA Manage Inventory - TO-BE	REV: 6 Mar. 1998	DRAFT			
	NOTES: 1 2 3 4 5 6 7 8 9 10		RECOMMENDED			A0
			PUBLICATION			



NODE: A2	TITLE: Receiving	NUMBER:
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Activity Name: Receiving  
Activity Number: A2  
Activity Description: Receiving consists of:

- A21 - Verify Inventory Received from Vendor
- A22 - Set Up Inventory Item
- A23 - Place Inventory in Bins
- A24 - Update Inv System with Receipt Info
- A25 - Calc Average Unit Price
- A26 - Create Receiving Reports
- A27 - Post Receiving Info to FMIS
- A28 - Update Unit Price in Inventory

A21 - Verify Inventory Received from Vendor – The vendor arrives with the inventory, the inventory is then loaded to the stock area, and signed for. A physical count is then taken against the invoice or packing slip.

A22 - Set Up Inventory Item - When a shop receives a new commodity code. The shop must go to the setup shop item window in the inventory system and a commodity code verification is made against the inventory commodity code table. Additional data is requested such as lead time, min/max, low stock, purge bin location, and the item is added to the shop item setup table.

A23 - Place Inventory in Bins – The inventory is then physically placed into bins.

A24 - Update Inv System with Receipt Info – The shop supply officer goes to the inventory system and pulls up the purchasing application screen and has the option of choosing PO list or go to PO number. The shop supply officer then goes to the receipt screen and enters quantity received by line item listing stock location, comments, date received and whom received by:

Receiving Issue:

1. POs are added to the inventory list but never deleted.
2. The PO status is not displayed. The system needs to show more accurate PO status such as open, partial receipt, and closed etc.

A25 - Calc Average Unit Price – Calculate the average unit price based on an average cost method by location.

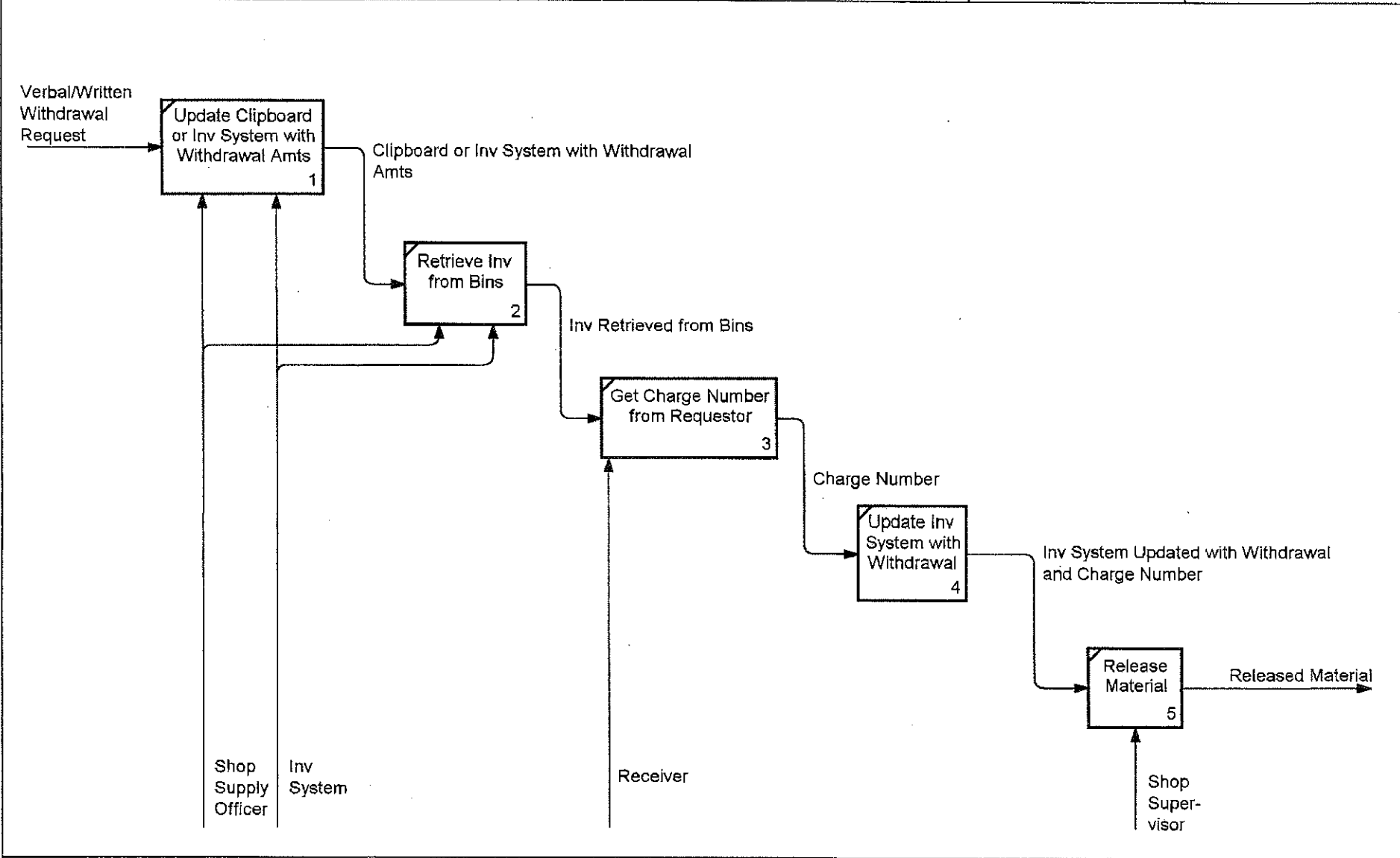
A26 - Create Receiving Reports – The inventory system generates the receiving reports. (Optional: These reports are filled with hard copies of invoices at the shop.)

A27 - Post Receiving Info to FMIS – The inventory system electronically passes the receiving information to FMIS.

A28 - Update Unit Price in Inventory – Update the unit price for variances between the PO unit price and the FMIS invoice unit price and recalculate the unit average price.

USED AT:	AUTHOR:	DATE: 23 Feb. 1998	WORKING	READER	DATE	CONTEXT A0
	PROJECT: SHA Manage Inventory - TO-BE	REV: 6 Mar. 1998	DRAFT			
			RECOMMENDED			
			PUBLICATION			

NOTES: 1 2 3 4 5 6 7 8 9 10



NODE: A3	TITLE: Withdrawal	NUMBER:
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Activity Name: Withdrawal  
Activity Number: A3  
Activity Description: Withdrawal consists of:

- A31 - Update Clipboard or Inv System with Withdrawal Amts
- A32 - Retrieve Inv from Bins
- A33 - Get Charge Number from Requestor
- A34 - Update Inv System with Withdrawal
- A35 - Release Material

A31 - Update Clipboard or Inv System with Withdrawal Amts – When the team leader or shop supervisor comes to the supply officer with a verbal or written request for an inventory item, the shop supply officer updates the clipboard (withdrawal sheet). At the shop's discretion, withdrawal data may be recorded on the clipboard or electronically with the clipboard used in emergency situations (i.e. storm events, network failure etc.)

A32 - Retrieve Inv from Bins – The shop supply officer goes to the bin location, ascertains the item, and updates the clipboard (withdrawal sheet).

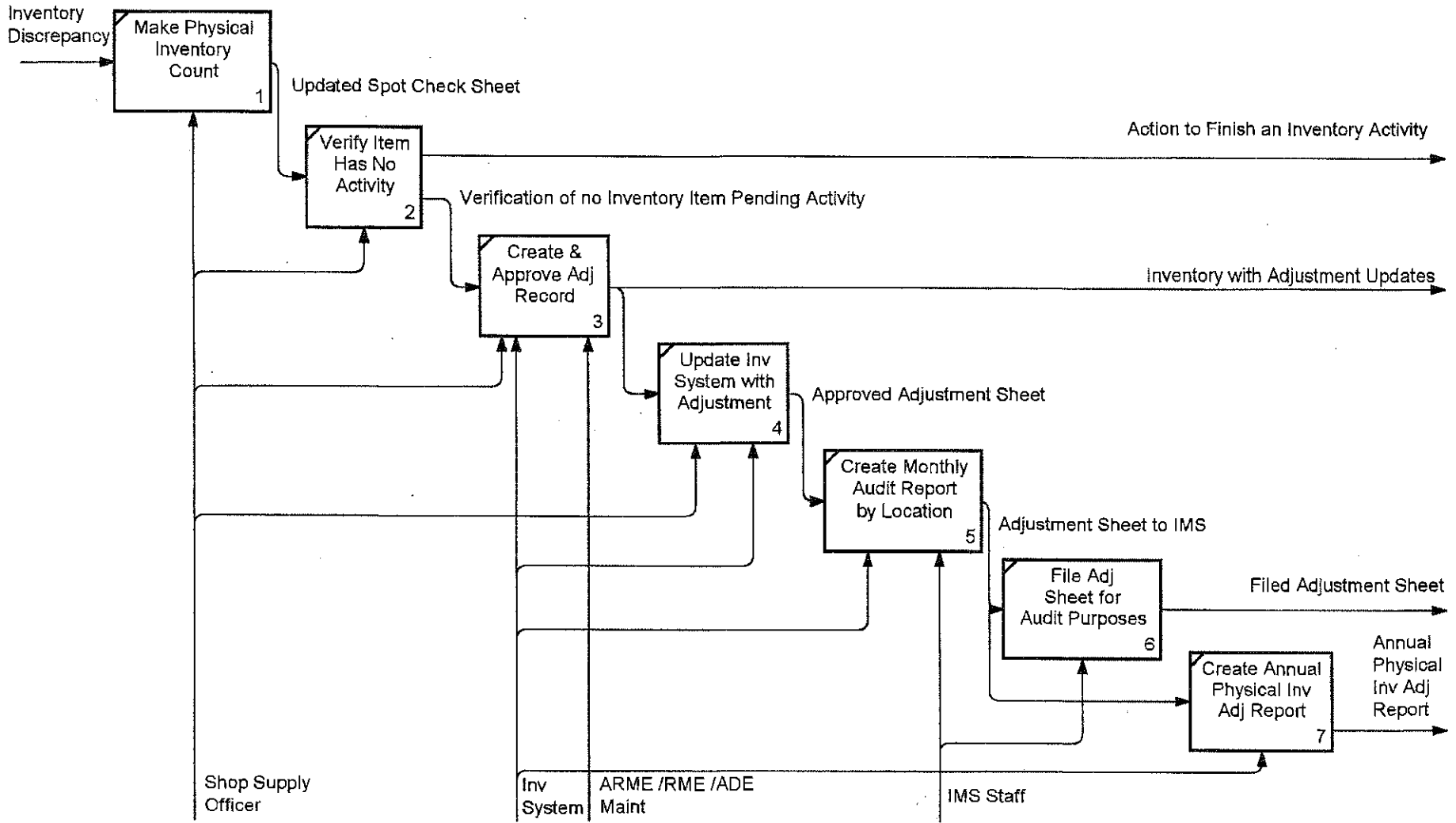
A33 - Get Charge Number from Requestor – The receiver provides the supply officer with a charge number. The receiver then signs for the material.

A34 - Update Inv System with Withdrawal – The shop supply officer uses the clipboard withdrawal information to post withdrawals in the inventory system.

A35 - Release Material – The inventory is then released to the requestor.

USED AT:	AUTHOR:	DATE: 23 Feb. 1998	WORKING	READER	DATE	CONTEXT A0
	PROJECT: SHA Manage Inventory - TO-BE	REV: 25 Feb. 1998	DRAFT			
			RECOMMENDED			
			PUBLICATION			

NOTES: 1 2 3 4 5 6 7 8 9 10



NODE: <b>A4</b>	TITLE: <b>Adjustment</b>	NUMBER:
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Activity Name: Adjustment  
Activity Number: A4  
Activity Description: Adjustment consists of:

- A41 - Make Physical Inventory Count
- A42 - Verify Item has No Activity
- A43 - Create & Approve Adj Record
- A44 - Update Inv System with Adjustment
- A45 - Create Monthly Audit Report by Location
- A46 - File Adj Sheet for Audit Purpose
- A47 - Create Annual Physical Inv Adj Report

A41 - Make Physical Inventory Count – The shop supply officers assures that all the products are in the proper location. The shop supply officer selects items at random and performs a physical count. The results are recorded on a physical count sheet and produced by the inventory system. The name of the physical count person must be recorded as part of the transaction.

A42 - Verify Item has No Activity – The shop supply officer verifies that receipts, withdrawals, transfers that are to be applied to the commodity code has been applied. If there are outstanding activities, the outstanding activity is completed.

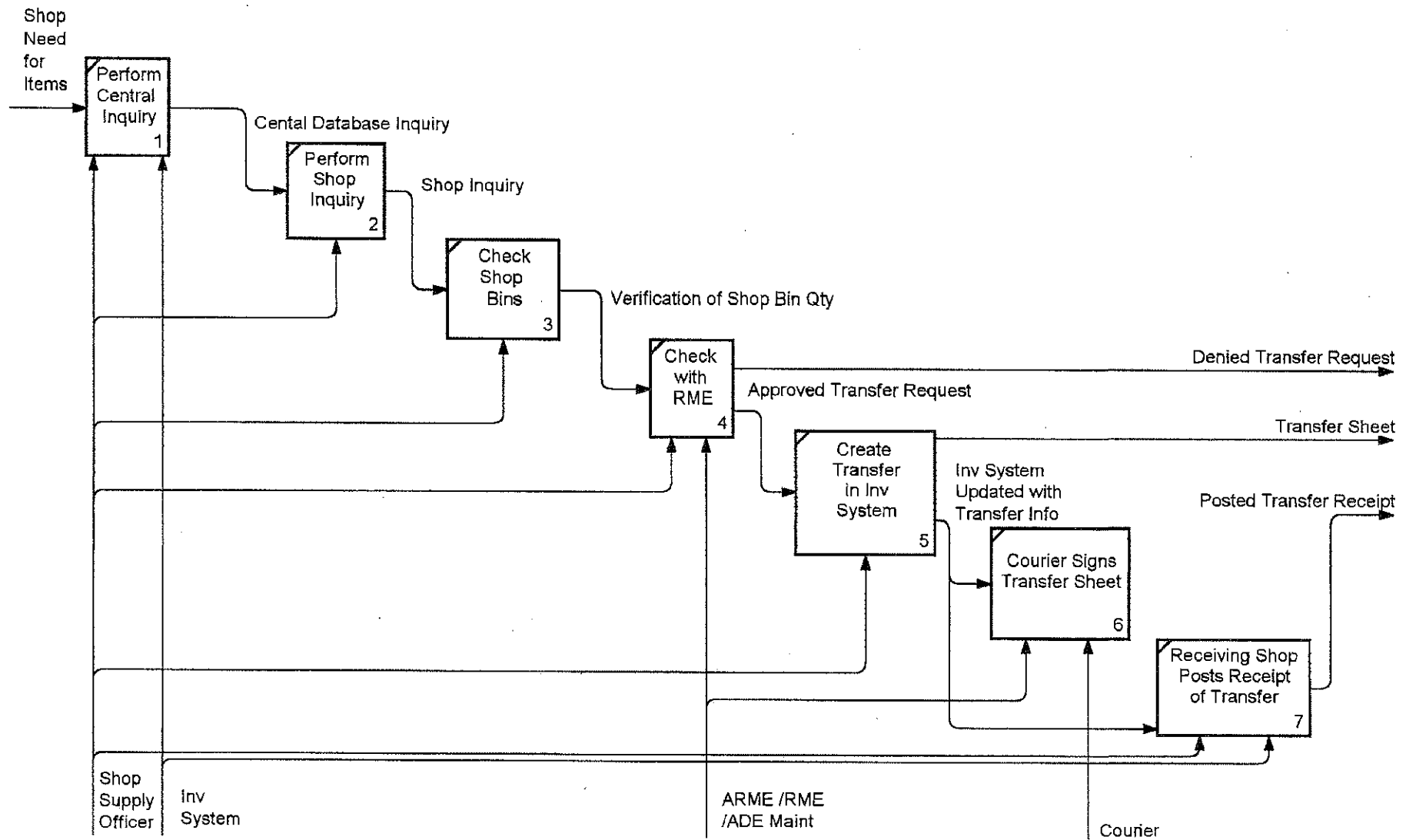
A43 - Create & Approve Adj Record – If a variance still exists after the physical inventory count and the verification that there are no activities against the inventory item, an inventory adjustment is created. This adjustment is forwarded to the ARME/RME/ADE based on dollar amount for electronic approval.

A44 - Update Inv System with Adjustment – The commodity code being adjusted is frozen until the adjustment passes though all levels of approval. Subsequent to approval the perpetual inventory quantity is adjusted.

A45 - Create Monthly Audit Report by Location - After the end of each month, IMS will generate a summary report of all monthly adjustments which is retained at IMS for subsequent review. Furthermore, IMS will generate a master summary report of adjustments by location for the month.

A46 - File Adj Sheet for Audit Purpose – IMS reviews and files the master summary report of adjustments.

A47 - Create Annual Physical Inv Adj Report – The shop and IMS generates the physical inventory adjustment report subsequent to the posting of all activity related to the yearend physical inventory. The copy is forwarded to the ADE for signature approval. After approval, the report is submitted to the IMS.





Activity Name: Transfer  
Activity Number: A5  
Activity Description: Transfer consists of:

- A51 - Perform Central Inquiry
- A52 - Perform Shop Inquiry
- A53 - Check Shop Bins
- A54 - Check with RME
- A55 - Create Transfer in Inv System
- A56 - Courier Signs Transfer Sheet
- A57 - Receiving Shop Posts Receipt of Transfer

A51 - Perform Central Inquiry – The shop supply officer performs an onhand inquiry by location(s) for a specific commodity code(s).

A52 - Perform Shop Inquiry – Informal communication between the shops verifies inventory items onhand and availability to be transferred. If acquired, a written request should be forwarded to the transferring shop from the requesting shop.

A53 - Check Shop Bins – The shop supply officer goes to the bins and physically verifies the quantity onhand.

A54 - Check with RME – The shop supply officer verbally contacts the RME. The RME will either verbally approve or deny the transfer.

A55 - Create Transfer in Inv System – The shop supply officer uses the inventory system transfer window to create a transfer out. This entry is to relieve the sending shop's inventory. As a result of this activity, an inventory transfer sheet is produced.

A56 - Courier Signs Transfer Sheet – The person transporting the items to the receiving shop signs the hardcopy produced in the previous activity. The original is retained by the transferring shop. A photocopy is given to the courier to accompany the inventory items.

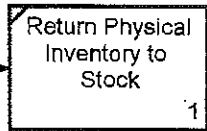
A57 - Receiving Shop Posts Receipt of Transfer – Upon arrival at the requesting shop, the items and the transfer sheet are presented to the shop supply officer. At this point, the quantity shipped is compared to the quantity noted on the transfer sheet.

The shop supply officer compares the transfer sheet to the list of incoming transfers in the inventory system. If the information is correct, the incoming transfer is posted. After posting, the inventory items are placed in storage.

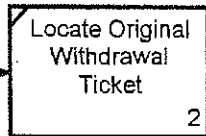
If the information is incorrect, the shop supply officers must work together to reconcile the differences in transfer quantities (possible actions could be additional transfers, inventory adjustments, etc.).

USED AT:	AUTHOR:	DATE: 23 Feb. 1998	WORKING	READER	DATE	CONTEXT
	PROJECT: SHA Manage Inventory - TO-BE	REV: 23 Feb. 1998	DRAFT			
	NOTES: 1 2 3 4 5 6 7 8 9 10		RECOMMENDED			A0
			PUBLICATION			

Inventory  
Withdrawal  
to be  
Reversed



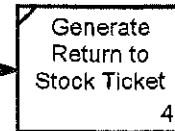
Physical Inventory Returned to Stock



Original Withdrawal Ticket



Return to Stock Info



Inventory Updated  
with Return to  
Stock

Shop Supply Officer

Inv System

NODE: A6	TITLE: Return to Stock	NUMBER:
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Activity Name: Return to Stock

Activity Number: A6

Activity Description: Return to Stock consists of:

- A61 - Return Physical Inventory to Stock
- A62 - Locate Original Withdrawal Ticket
- A63 - Make Return to Stock Entry
- A64 - Generate Return to Stock Ticket

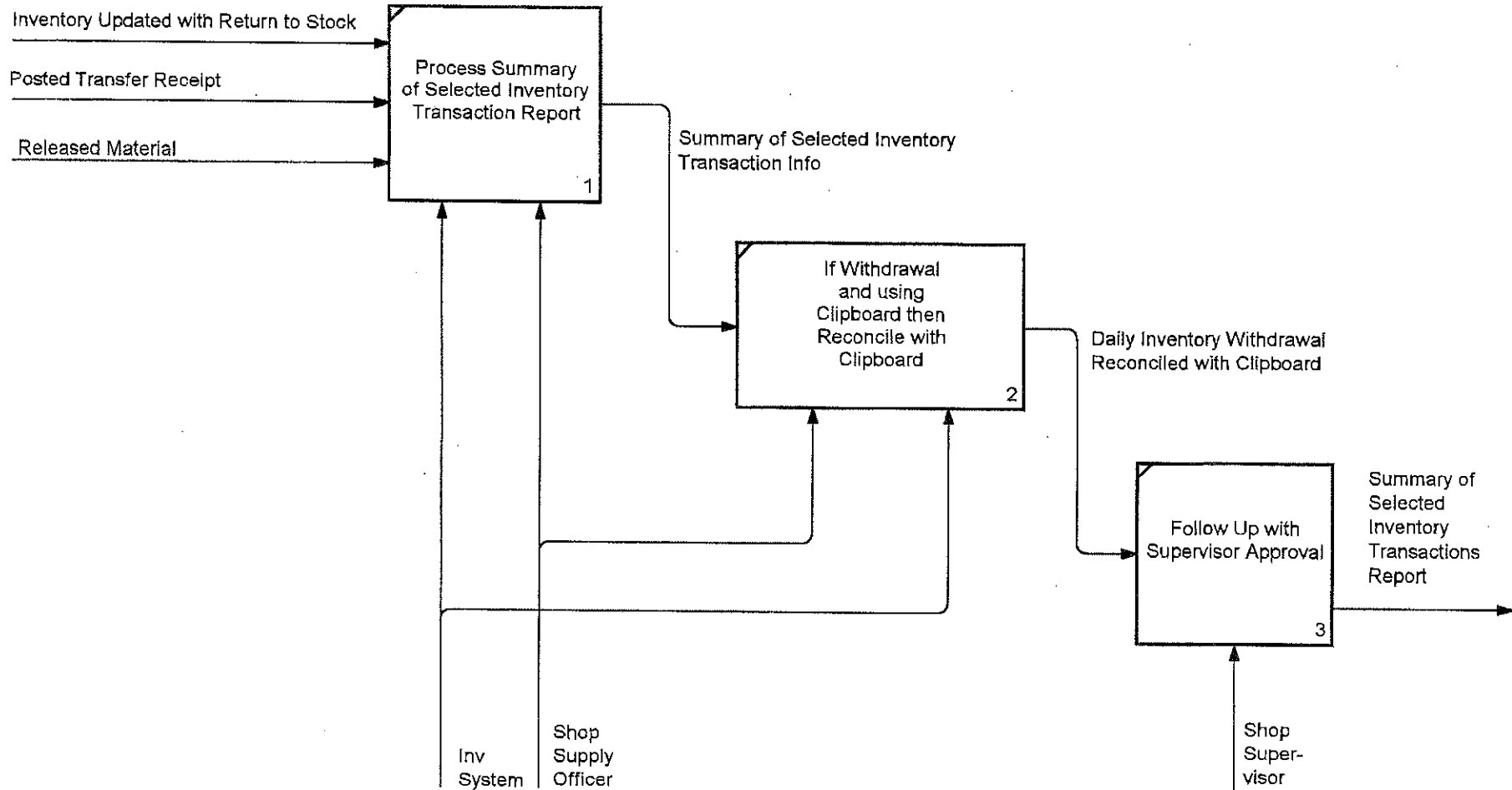
A61 - Return Physical Inventory to Stock – The shop supply officer finds the original bin location and physically puts the inventory back in the storage location.

A62 - Locate Original Withdrawal Ticket – The shop supply officer locates the original withdrawal ticket.

A63 - Make Return to Stock Entry – The shop supply officer accesses the return to stock window and locates the original withdrawal transaction. The item(s) to be returned is(are) selected from this withdrawal data. The shop supply officer enters the quantity to return to stock.

A64 - Generate Return to Stock Ticket – Upon completion of the return to stock entry, the inventory system will allow the shop supply officer to print a return to stock ticket. The shop supply officer must sign the return to stock ticket. (Note: Activity A64 – Generate Return to Stock Ticket is optional.)

USED AT:	AUTHOR:	DATE: 23 Feb. 1998	WORKING	READER	DATE	CONTEXT
	PROJECT: SHA Manage Inventory - TO-BE	REV: 6 Mar. 1998	DRAFT			A0
	NOTES: 1 2 3 4 5 6 7 8 9 10		RECOMMENDED			
			PUBLICATION			



NODE: <b>A7</b>	TITLE: <b>Generate Daily Inventory Trans Summary</b>	NUMBER:
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Activity Name: Generate Daily Inventory Trans Summary

Activity Number: A7

Activity Description: Generate Daily Inventory Trans Summary consists of:

- A71 - Process Summary of Selected Inventory Transactions Report
- A72 - If Withdrawal and Using Clipboard then Reconcile with Clipboard
- A73 - Follow Up with Supervisor Approval

A71 - Process Summary of Selected Inventory Transactions Report – At the end of the day the shop (or both shops in the case of a transfer) generates the Summary of Selected Inventory Transactions Report. The report will reflect the day's activities for selected inventory transactions (withdrawals, return to stock, and transfers out).

A72 - If Withdrawal and Using Clipboard then Reconcile with Clipboard – If the inventory action is a withdrawal and the clipboard is being used, the shop supply officer compares/reconciles/resolves discrepancies between the daily inventory transaction summary (with reference to withdrawal transactions) and clipboard data.

A73 - Follow Up with Supervisor Approval – The supervisor or his /her designated appointee must sign the Summary of Selected Inventory Transactions Report.

Activity Name: Update FMIS Daily Inventory Activity  
Activity Number: A8  
Activity Description: Update FMIS Daily Inventory Activity consists of the following:

- I - FMIS Daily Inventory Activity Requirements
- II - Inventory System to FMIS Interface Fields
- III - FMIS to Inventory System Interface PO Fields
- IV - Inventory System to FMIS Interface (API)
- V - Interface Lookup Tables
- VI - Inventory Transaction Postings
  - 1. Transfer Posting
  - 2. Return to Stock Posting
  - 3. Adjustment Posting
  - 4. Withdrawal Posting

I - FMIS Daily Inventory Activity Requirements:

1. The inventory system will update FMIS with inventory transactions on a daily basis.
2. The inventory fields which are to be passed to FMIS must match the FMIS fields.
3. An error log and record count must be maintained by the System Administrator to ensure that all the records which are sent from the Inventory System to FMIS are received by FMIS and vice versa.
4. Batch transactions are currently limited to 999 transactions.
5. Both sides of the inventory transaction must be passed to FMIS.
6. The new inventory system must accommodate Winter/Routine PCA changes.
7. Receipt data must be sent to FMIS.
8. Records that have been passed to FMIS must be flagged.
9. Upfront edits must be made before records are passed to FMIS.

II – Inventory System to FMIS Interface Fields:

1. Index
2. Charge Index
3. PCA
4. Proj No
5. AOBJ
6. Agency Code 1
7. Agency Code 2
8. Agency Code 3
9. Multipurpose Code
10. Transaction Code
11. Commodity Code
12. Property No
13. Extended Amount
14. Withdrawal Ticket No
15. Sent to FMIS flag

III – FMIS to Inventory System Interface PO Fields:

1. Index
2. Order No
3. PO Creation Date
4. Vendor Name
5. Delivery Date
6. Buyer-Emp-No
7. PO Status
8. Line No
9. Commodity Code
10. Quantity Ordered
11. Unit Cost
12. Unit of Measure
13. PO Initiator
14. PCA
15. Mfg Part No.

#### IV – Inventory System to FMIS Interface – Application Program Interface (API)

1. The inventory system will, in many cases, create only one posting side of the inventory transaction.
2. The API must create the remaining side of the transaction/change the PCA to the correct seasonal PCA and format it so that FMIS will accept it.
3. FMIS will accept the file from the API and apply the postings.

Note: The advantage of this approach is:

1. This approach is the most cost effective way to accomplish the Inventory System to FMIS interface.
2. From a programming perspective, this is more easy to program and maintain.

#### V - Interface Lookup Tables

The Inventory System to FMIS API will house two interface tables which will contain the seasonal PCA information needed in order to create valid postings.

The algorithm for the postings are defined below. The interface will consist of the following two lookup tables:

1. **Index PCA Lookup**
2. **Index PCA Commodity Lookup**

The Index PCA Lookup table will consist of the following fields:

- Index
- Routine PCA
- Inv Adj Routine PCA

The Index PCA Commodity Lookup table will consist of the following fields:

- Index
- Commodity Code
- Winter PCA
- Inv Adj PCA



## VI - Inventory Transaction Postings

There are four types of Inventory Transaction Postings:

- Withdrawal Posting
- Adjustment Posting
- Return to Stock Posting
- Transfer Posting

### 1. Transfer Posting

Note: Both sides of the posting (DR and CR) are accomplished in the inventory system.

#### DR (Transfer To)

1. AOBJ = 9060
2. Index (must be an inventory location)
3. PCA (looked up based on index being charge to and commodity code using lookup table in the inventory system)
4. Commodity Code
5. Extended Price

Change the PCA for the DR in the Interface if the Commodity Code is a Winter Commodity Code

6. If the commodity code is a winter commodity code, change the PCA to a winter PCA using the Index PCA Commodity Lookup table

#### CR (Transfer From)

1. Transfer from Index (System derives this from the login index)
2. AOBJ = 9060 (System sets to 9060)
3. PCA (Looked up based on index being relieved using lookup table)
4. Commodity Code
5. Extended Price

Change the PCA for the CR in the Interface if the Commodity Code is a Winter Commodity Code

6. If the commodity code is a winter commodity code, change the PCA to a winter PCA using the Index PCA Commodity Lookup table

Note: This activity is ready for FMIS overnight posting. However, this activity is not closed until the receiving shop physically receives the inventory and the quantity onhand is updated.

2. Return to Stock Posting

Note: Both sides of the posting (DR and CR) are accomplished in the inventory system.

DR

1. Index based on location (Based on user login)
2. Withdrawal ticket no (Selected from a list of withdrawal ticket no for the user user login index; this is not sent)
3. Commodity Code (Selected from withdrawal ticket)
4. Extended Price
5. AOBJ = 9060
6. PCA (Looked up based on index being charged using looknp table in inventory system)
7. Return to Stock Ticket No

Change the PCA for the DR in the Interface if the Commodity Code is a Winter Commodity Code

8. If the commodity code is a winter commodity code, change the PCA to a winter PCA using the Index PCA Commodity Lookup table

CR

1. Index (Derived from the withdrawal ticket)
2. PCA/Project **(DO NOT CHANGE PCA IN THE API)**
3. AOBJ (Derived from the withdrawal ticket)
4. Property Id (Derived from the withdrawal ticket)
5. Agency Code 1 (Derived from the withdrawal ticket)
6. Agency Code 2 (Derived from the withdrawal ticket)
7. Agency Code 3 (Derived from the withdrawal ticket)
8. Multipurpose Code (Derived from the withdrawal ticket)
9. Commodity Code
10. Extended Price
11. Return to Stock Ticket Number

3. Adjustment Posting

The adjustment posting consists of two parts:

- Detail Adjustment Posting
- Summary Adjustment Posting to Offset the Detail

3.1 Detail Adjustment Posting

Note: An adjustment detail posting may be a DR or a CR. The direction of the posting is determined by the dollars (positive or negative).

1. User Index (System derives this from login index)
2. Commodity Code
3. AOBJ (Based on commodity code)
4. Adj PCA (Using Shop Table)
5. Extended price

The interface performs the next steps:

6. If the transaction is a DR and the commodity code is a winter commodity code then change the PCA using the Index PCA Commodity Lookup.
7. If it is a CR then perform the following:
  1. Charge Index (System derives from person posting adjustment)
  2. Location Index (The Relief index)
  3. PCA (Looked up using interface Index PCA Lookup table)
  4. AOBJ = 9060
  5. Extended price
  6. Commodity code
  7. If the commodity code is a winter commodity code, then change the PCA using the interface Index PCA Commodity Lookup

3.2 Summary Adjustment Posting to Offset the Detail

1. Extract the daily adjustments and send it to the API interface program.
2. If the transaction has a winter commodity then change the PCA using the Index PCA Commodity Lookup
3. The detail transactions are now ready to be interfaced with FMIS.

### 3.3 Summary Adjustment Posting to Offset the Detail Transaction

1. Take the updated extract of the daily adjustments after changes for winter PCAs and isolate the transactions by location index through the API.
2. Next, isolate transactions with winter commodity codes/PCAs through the index PCA Commodity Code Lookup.
3. Summarize the winter transactions and create 412/413 transactions to pass to FMIS depending on the direction of the summarized transaction (412=debit, 413=credit). Also, pass the charge index, PCA (from the index PCA Lookup) and AOBJ 9060.
4. Summarize the remaining transactions for that index and pass the Charge Index, PCA (from the Index PCA Lookup for Inventory Adjustment PCA) and AOBJ 9060.
5. Send #3 and #4 to FMIS along with details updated in 3.2.

4. Withdrawal Posting

The withdrawal posting consists of two parts:

- Detail Withdrawal Posting
- Summary Withdrawal Posting to Offset the Detail

4.1 Detail Withdrawal Posting

DR

1. User Index (System derives this from login index)
2. Commodity Code
3. AOBJ (Based on commodity code)
4. Transaction Code (413 for DR, 412 for CR)
5. Adj PCA (Based on index and is determined in the inventory system)
6. Extended price

CR

This is created in the interface

1. Charge Index (Based on location)
2. Location Index (Relief Index)
3. PCA (Looked up using interface Index PCA Lookup table)
4. AOBJ = 9060
5. Extended price
6. Commodity code
7. If the commodity code is a winter commodity code, then change the PCA using the interface Index PCA Commodity Lookup

3.2 Summary Withdrawal Posting to Offset the Detail

1. Extract the daily withdrawals and send the DR to the API interface program.
2. Isolate the location index transactions  
If the commodity code is a winter commodity code then set it to a Winter PCA  
Total the transactions
3. Look for transactions with winter commodity codes
4. Summarize the remaining transactions, lookup the index, and plug in the Routine PCA

Note: Lines 3 & 4 of the summary will be sent to FMIS.

**STATE HIGHWAY ADMINISTRATION**  
**MANAGE INVENTORY**  
**TO-BE IDEF0 PROCESS MODEL**

**GLOSSARY OF TERMS**

**Inputs:**

1. AOBJ 9070 & Specific PCA for PO/Req – The essential financial coding for inventory items. This combination of financial coding identifies purchase orders for extract in FMIS. These extracted POs are then downloaded to the inventory. The criteria for the extract of the PO is as follows: AOBJ = 9060, PCA = 23595, 23870, 23888, 18003 and the Winter PCA (tbd). The following PO fields are passed from FMIS to the Inventory System: Index, Order No, PO Creation Date, Vendor Name, Delivery Date, Buyer-Emp-No, PO Status, Line No, Commodity Code, Quantity Ordered, Unit Cost, Unit of Measure, PO Initiator, PCA.
2. Inventory Discrepancy – Difference in physical count (quantity onhand) versus perpetual count.
3. Inventory Withdrawal to be Reversed – A return to stock inventory item.
4. Shop Need for Items – A shop need for an inventory item which might be transferred from another shop.
5. Vendor PO/Packing Slip – A document provided by the vendor indicating items that shipped. (This could be the vendor's invoice).
6. Verbal/Written Withdrawal Request – A request for an inventory item that may a written document containing the following information: item description, index number, PCA or charge number, stock number, unit of issue, quantity, requestor signature.

**Constraint:**

1. COMAR 21 – Statewide procurement regulation for purchasing.

## **Outputs:**

1. Action to Finish an Inventory Activity – When performing an adjustment, all inventory activities must be completed. If there are outstanding activities against the inventory item, then the user is notified that there is an action to finish the inventory activity.
2. Annual Physical Inv Adj Report – A yearend report of physical inventory activity.
3. Summary of Selected Inventory Transaction Report – A daily report identifying all inventory activities (withdrawals, return to stock, and transfers).  
Note: A requirement is that the withdrawals will be sorted to the top of the report. The report requires a supervisor signature.
4. Denied Transfer Request – An informal shop notification that a transfer request from another shop is denied.
5. Disapproved PO Request Notification – A formal/informal notification that a shop purchase order request has been denied.
6. Filed Adjustment Sheet – A master summary report of adjustments which IMS files for audit purposes.
7. FMIS Updated with Daily Inventory Transactions – FMIS is updated on a daily basis with inventory transaction postings.
8. Inv DB Updated with Vendor PO - The purchase order information is sent from FMIS to the inventory system through a nightly batch program.
9. Inventory Updated with Return to Stock – The inventory system is updated with a return to stock transaction
10. Inventory with Adjustment Updates – The inventory system is updated with an adjustment transaction.
11. PO to Vendor – The issuance of a purchase order to a vendor from a shop. This occurs after a shop supply officer receives approval from FMIS to physically procure material.
12. Posted Transfer Receipt – The transfer receipt is posted in the inventory system.
13. Receiving Reports & Receipt Info – After an inventory item has been received and the unit average price is calculated, a receiving report is generated and details pertaining to the receipt transaction is sent to FMIS.
14. Released Material – The inventory system releases the material to a requestor/receiver at the end of the withdrawal transaction.
15. Transfer Sheet – A sheet showing items that are transferred from one shop to another shop.
16. Updated Unit Price – The unit price for an inventory item is updated as part of the receiving process using an average cost method.

17. Vendor Reconciliation of Physical Inventory Received – During the receiving process, when the vendor arrives with inventory, a physical count is taken against the invoice and the packing slip. If differences should occur, a vendor reconciliation of the physical inventory received is conducted.

**Mechanisms:**

1. ARME/RME/ADE Maint –  
ARME – Assistant Resident Maintenance Engineer.  
RME – Resident Maintenance Engineer responsible for overall shop operations.  
ADE Maint – Assistant District Engineer responsible for the District Maintenance activities. (The RME's report to the ADE's).
2. Courier – The person who transfer goods from Point A to Point B.
3. FMIS – MDOT Financial Management information mainframe system.
4. IMS Staff - SHA OFIT sections that provides oversight and support over the inventory function.
5. Inv System – The proposed TO-BE inventory system.
6. Shop Supervisor – The person responsible for overall shop functions in a non-maintenance shop.
7. Shop Supply Officer- The person responsible for procurement and distribution of shop/location related activities.
8. Receiver – An individual who receives the withdrawal of an inventory item.



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**MANAGE INVENTORY  
WORK IN PROCESS**

**TO-BE IDEF0 PROCESS MODEL**

**Prepared for:  
State Highway Administration  
(SHA)**

**Publication: March 31, 1998**

**STATE HIGHWAY ADMINISTRATION**  
**MANAGE INVENTORY ACTIVITY – WORK IN PROCESS**  
**TO-BE IDEF0 PROCESS MODEL**

**Introduction**

This document represents the MANAGE INVENTORY – WORK IN PROCESS TO-BE IDEF0 process model for the State Highway Administration (SHA). Activities: A1 – Purchasing, A2 – Receiving, A3 – Withdrawal, A4 – Adjustment, A5 – Transfer, A6 – Return to Stock, A7 - Generate Daily Inventory Trans Summary, and A8 – Update FMIS with Daily Inventory Activity are the same as the activities modeled in the SHA MANAGE INVENTORY document. As a result, these activities and their associated inputs, constraints, outputs, and mechanisms are not decomposed or defined in this writeup.

The model consists only of the MANAGE INVENTORY –WORK IN PROCESS TO-BE IDEF0 process model with MANAGE INVENTORY – WORK IN PROCESS model definitions identified in the glossary of the document.

**Viewpoint**

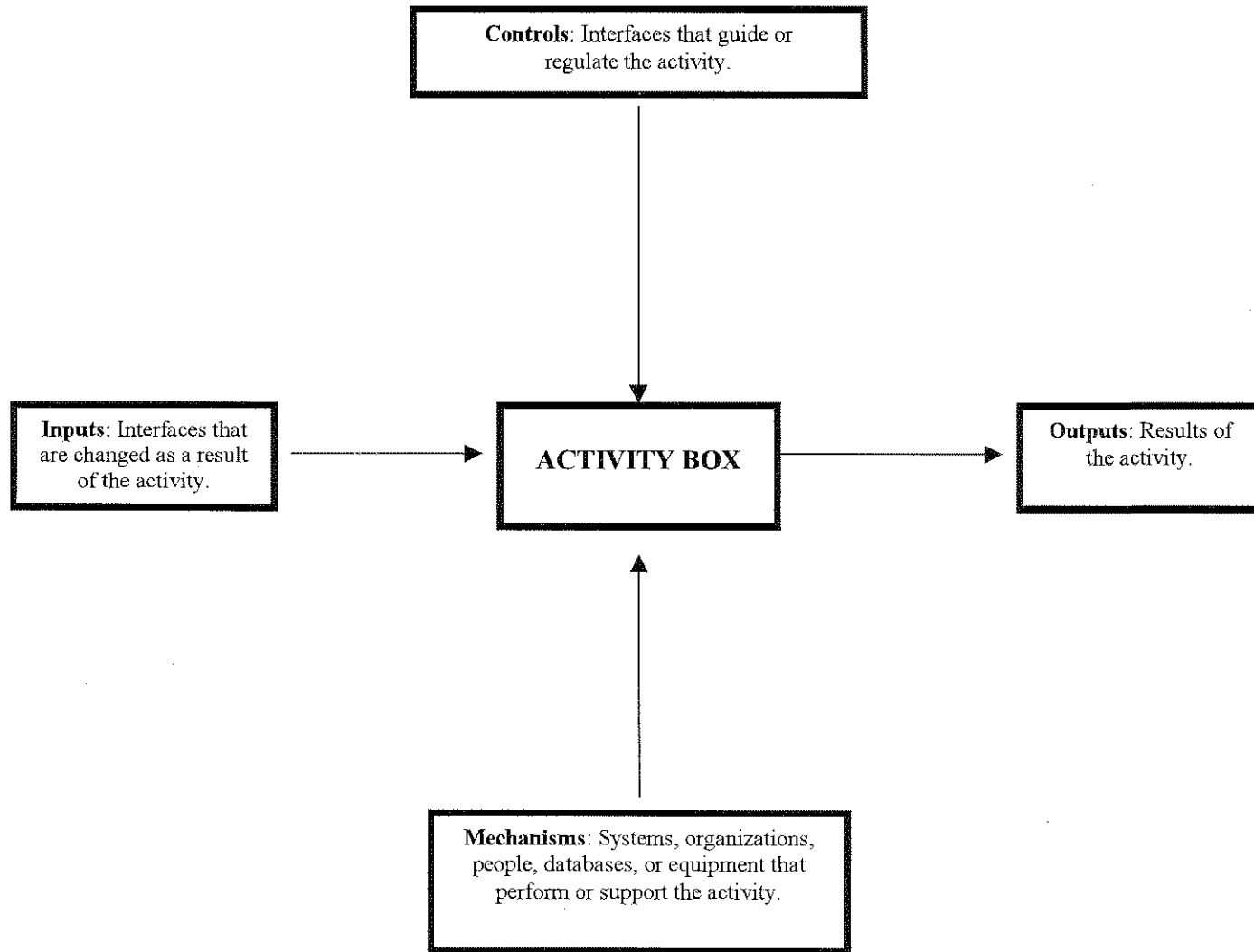
The viewpoint is the point of view that is assumed when constructing the model. The SHA JAD participants identified the viewpoint of the Manage Inventory TO-BE IDEF0 State Highway Administration AS-IS MANAGE INVENTORY - WORK IN PROCESS activity to be that of the State Highway Administration Inventory Management Staff.

**Purpose**

The purpose is the statement of why the model is being constructed. The purpose statement is a clear statement of what the model will be used to accomplish. Inventory management staff determined that the purpose of the “Management Inventory – WORK IN PROCESS” activity is to:

- Provide day to day inventory functionality
- Be effective and efficient
- Eliminate the reentering of duplicate data
- Provide accurate inventory balances
- Provide user friendly reporting capability/outputs
- Provide the capability to record accounting and transfers to FMIS and other systems as identified
- Comply with internal controls such as security

## IDEF0 ACTIVITY CONVENTIONS



### **Context Diagram**

The context Diagram is established for the activity on the A-0 diagram. The context is the way in which the activity “Manage Inventory Program Activity” interfaces with the larger world.

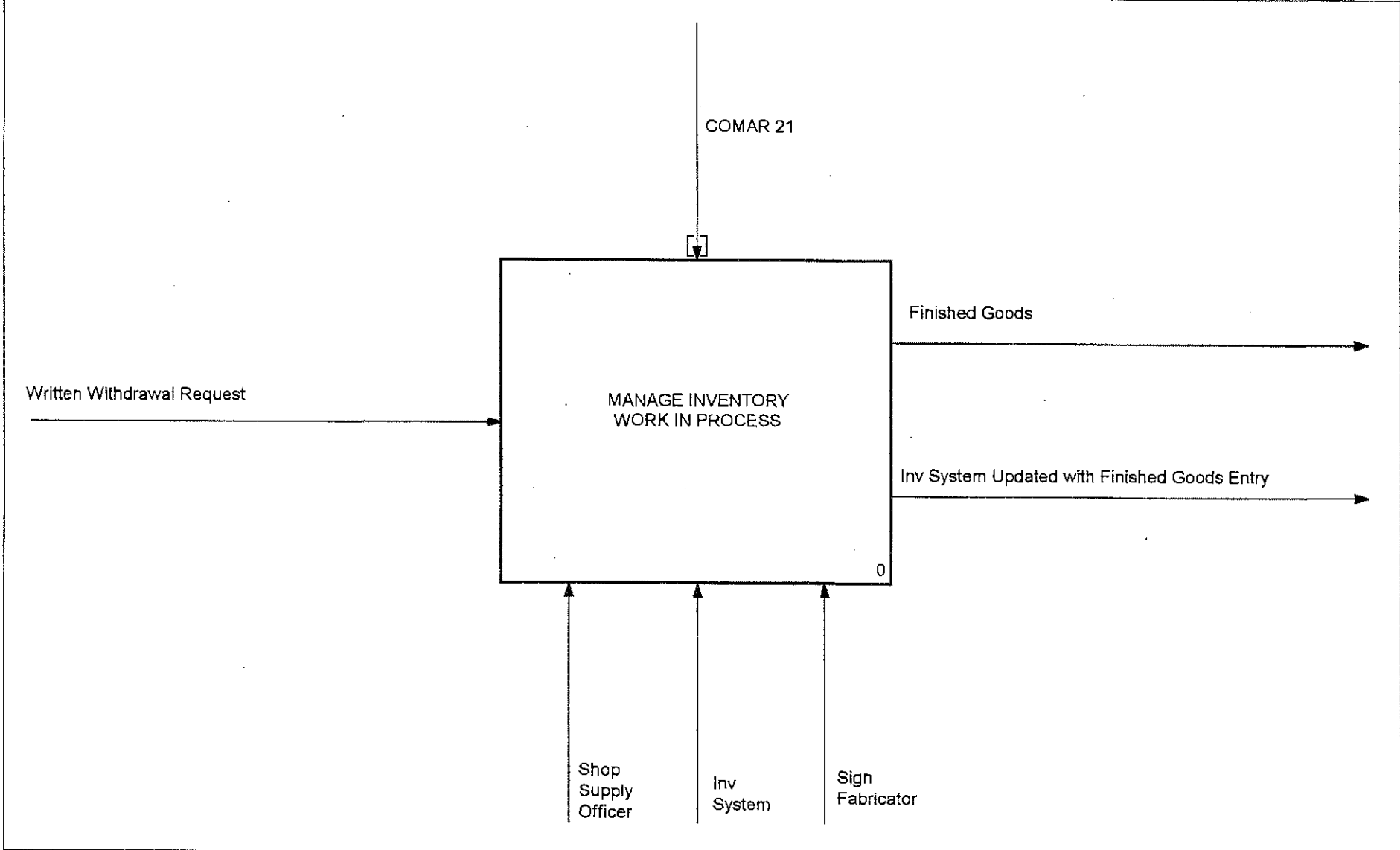
### **Activity Box**

Activity boxes represent functions, operations, processes, and transformations. An activity describes what happens in a particular environment. It transforms or processes an input and activity produces one or more recognizable results. Activities are performed by people, machine, computer systems, etc.

### **Glossary of Terms**

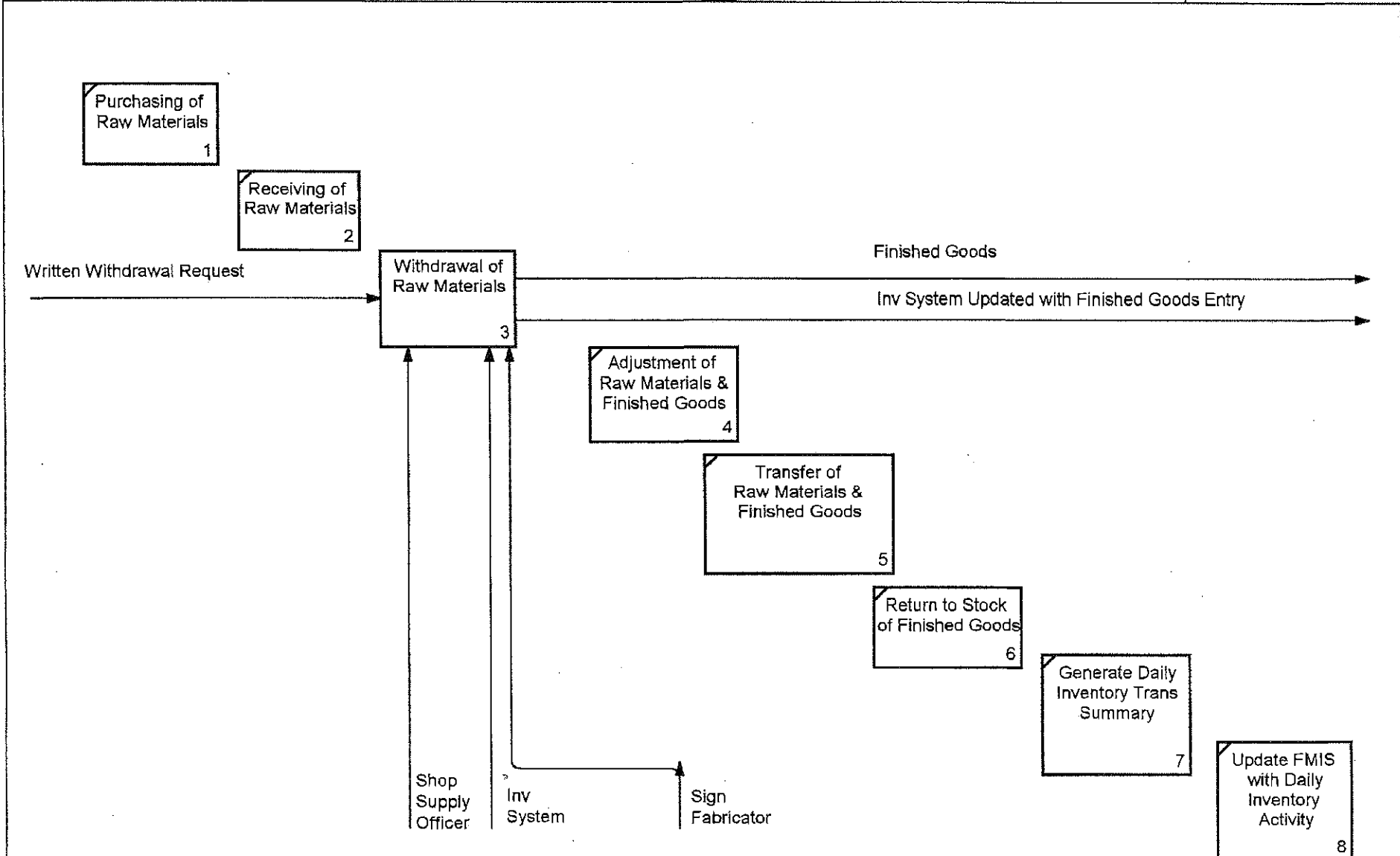
The Glossary of Terms is used to augment the IDEF0 Process Model and contains the name and definition of the input, output control and mechanism arrows.

USED AT:	AUTHOR:	DATE: 15 Jan. 1998	WORKING	READER	DATE	CONTEX <b>NONE</b>
	PROJECT: SHA MANAGE INVENTORY - TO-BE WIP WITHDRAWAL	REV: 4 Mar. 1998	DRAFT			
			RECOMMENDED			
	NOTES: 1 2 3 4 5 6 7 8 9 10		PUBLICATION			



NODE: <b>A-0</b>	TITLE: <b>MANAGE INVENTORY WORK IN PROCESS</b>	NUMBER:
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USED AT:	AUTHOR:	DATE: 15 Jan. 1998	WORKING	READER	DATE	CONTEXT
	PROJECT: SHA MANAGE INVENTORY - TO-BE WIP WITHDRAWAL	REV: 4 Mar. 1998	DRAFT			TOP
			RECOMMENDED			
	NOTES: 1 2 3 4 5 6 7 8 9 10		PUBLICATION			



NODE: A0	TITLE: MANAGE INVENTORY WORK IN PROCESS	NUMBER:
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USED AT:	AUTHOR:	DATE: 15 Jan. 1998	WORKING	READER	DATE	CONTEXT
	PROJECT: SHA MANAGE INVENTORY - TO-BE WIP WITHDRAWAL	REV: 4 Mar. 1998	DRAFT			
	NOTES: 1 2 3 4 5 6 7 8 9 10		RECOMMENDED			
			PUBLICATION			A0

Written  
Withdrawal  
Request

Update Clipboard  
with Withdrawal  
Amounts  
1

Updated clipboard with withdrawal amounts

Retrieve Inventory  
from Bin  
2

Reduced inventory from bins

Perform Daily  
Computer  
Withdrawal Update  
3

Inv System updated with withdrawal updates

Combine Raw  
Materials to Make  
Finished Goods  
4

Finished  
Goods  
information

Make Finished  
Goods Entry  
in Inv System  
5

Inv System  
Updated with  
Finished Goods  
Entry

Finished Goods

Shop  
Supply  
Officer

Inv  
System

Sign  
Fabricator

NODE: A3

TITLE: Withdrawal of Raw Materials

NUMBER:

**Activity Name:** Withdrawal of Raw Materials  
**Activity Number:** A3  
**Activity Description:** Withdrawal of Raw Material consists of:

- Update Clipboard with Withdrawal Amounts
- Retrieve Inventory from Bin
- Perform Daily Computer Withdrawal Updates
- Combine Raw Materials to Make Finished Goods
- Make Finished Goods Entry in Inv System

Update Clipboard with Withdrawal Amounts - When the team leader or shop supervisor comes to the supply officer with a written request for an inventory item, the shop supply officer updates the clipboard (withdrawal sheet).

Retrieve Inventory from Bin – The shop supply officer goes to the bin location and ascertains the item.

Perform Daily Computer Withdrawal Updates – A raw material withdrawal entry is made in the Inventory System into Work in Process.

Combine Raw Materials to Make Finished Goods – The raw materials that have been withdrawn is used to fabricate a sign or signs.

Make Finished Goods Entry in Inv System – After a sign or signs have been fabricated, an entry is made in the Inventory System to record the creation of finished goods inventory which will have a unique stock number and unit cost. The finished goods entry increases the finished goods balance onhand and relieves WIP. Completion of the finished goods entry results in a hard copy that documents the finished goods entry. At this point, one of two scenarios may occur:

Scenario 1 – If the sign is custom ordered, the sign is immediately withdrawn from the finished goods and shipped to its destination. Please note that custom ordered signs are assigned to one bin location subsequent to withdrawal the balances for custom ordered signs should be zero.

Scenario 2 - If the sign is a stock item, the sign is placed in a bin based on its commodity code.

**Requirements:**

1. Need to reduce Work in Process account for cost of finished goods in FMIS.
2. There should be a document trail for all finished goods entries.



**The following activities are the same as the activities identified in the MANGE INVENTORY – TO-BE IDEF0 Process Model and are not defined in this document. See MANAGE INVENTORY – TO-BE IDEF0 Process Model for details on each of the activities identified below.**

**Activity Name:** Purchasing of Raw Materials  
**Activity Number:** A1  
**Activity Description:** Same as MANAGE INVENTORY – TO-BE IDEF0 Process Model (A1 – Purchasing).

**Activity Name:** Receiving of Raw Materials  
**Activity Number:** A2  
**Activity Description:** Same as MANAGE INVENTORY – TO-BE IDEF0 Process Model (A2 – Receiving).

**Activity Name:** Adjustment of Raw Materials & Finished Goods  
**Activity Number:** A4  
**Activity Description:** Same as MANAGE INVENTORY – TO-BE IDEF0 Process Model (A4 – Adjustment).

**Activity Name:** Transfer of Raw Materials & Finished Goods  
**Activity Number:** A5  
**Activity Description:** Same as MANAGE INVENTORY – TO-BE IDEF0 Process Model (A5 – Transfer).

**Activity Name:** Return to Stock of Finished Goods  
**Activity Number:** A6  
**Activity Description:** Same as MANAGE INVENTORY – TO-BE IDEF0 Process Model (A6 – Return to Stock).

**Activity Name:** Generate Daily Inventory Tans Summary  
**Activity Number:** A7  
**Activity Description:** Same as MANAGE INVENTORY – TO-BE IDEF0 Process Model (A7 – Generate Daily Inventory Trans Summary)

**Activity Name:** Update FMIS with Daily Inventory Activity  
**Activity Number:** A8  
**Activity Description:** Same as MANAGE INVENTORY – TO-BE IDEF0 Process Model (A8 – Update FMIS with Daily Inventory Activity).

**STATE HIGHWAY ADMINISTRATION**  
**MANAGE INVENTORY ACTIVITY – WORK IN PROCESS**  
**TO-BE IDEF0 PROCESS MODEL**  
**GLOSSARY OF TERMS FOR A3 – WITHDRAWAL OF RAW MATERIALS**

**Input**

1. Written Withdrawal Request – A written request to withdraw shop inventory.

**Constraint:**

1. COMAR 21 – Statewide procurement regulation for purchasing.

**Output**

1. Finished Goods – The signs that are fabricated from the Sign Shop.

**Mechanisms:**

1. Sign Fabricator – Employees responsible for the making of the sign.
2. Shop Supply Officer – Person responsible for procurement and distribution of shop/location related activities.
3. Inventory System – The TO-BE inventory system.

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**MANAGE INVENTORY**

**TO-BE IDEFIX DATA MODEL**

**Prepared for:**  
**State Highway Administration**  
**(SHA)**

**Publication: March 31, 1998**

**STATE HIGHWAY ADMINISTRATION**  
**MANAGE INVENTORY ACTIVITY**  
**TO-BE IDEF1X DATA MODEL**

**Introduction**

This document presents the TO-BE IDEF1X Data Model for the State Highway Administration (SHA). The document consists of an IDEF1X Data Model with Data Model entity and attribute descriptions identified in the Data Dictionary section of the document. It is the product of the SHA JAD sessions which were conducted at State Highway Administration. The objective of the JAD sessions was to develop a data model of the current SHA information needs and to capture the business rules and data requirements for the future SHA inventory system.

The IDEF1X TO-BE Data Model in conjunction with the IDEF0 TO-BE Process Model will be used to build consensus on future inventory system activities to be related to critical success factors and to requirements for the future SHA inventory system.

**TO-BE IDEF1X Data Model**

The TO-BE IDEF1X data model depicts the future SHA Inventory information needs. It consists of two main parts:

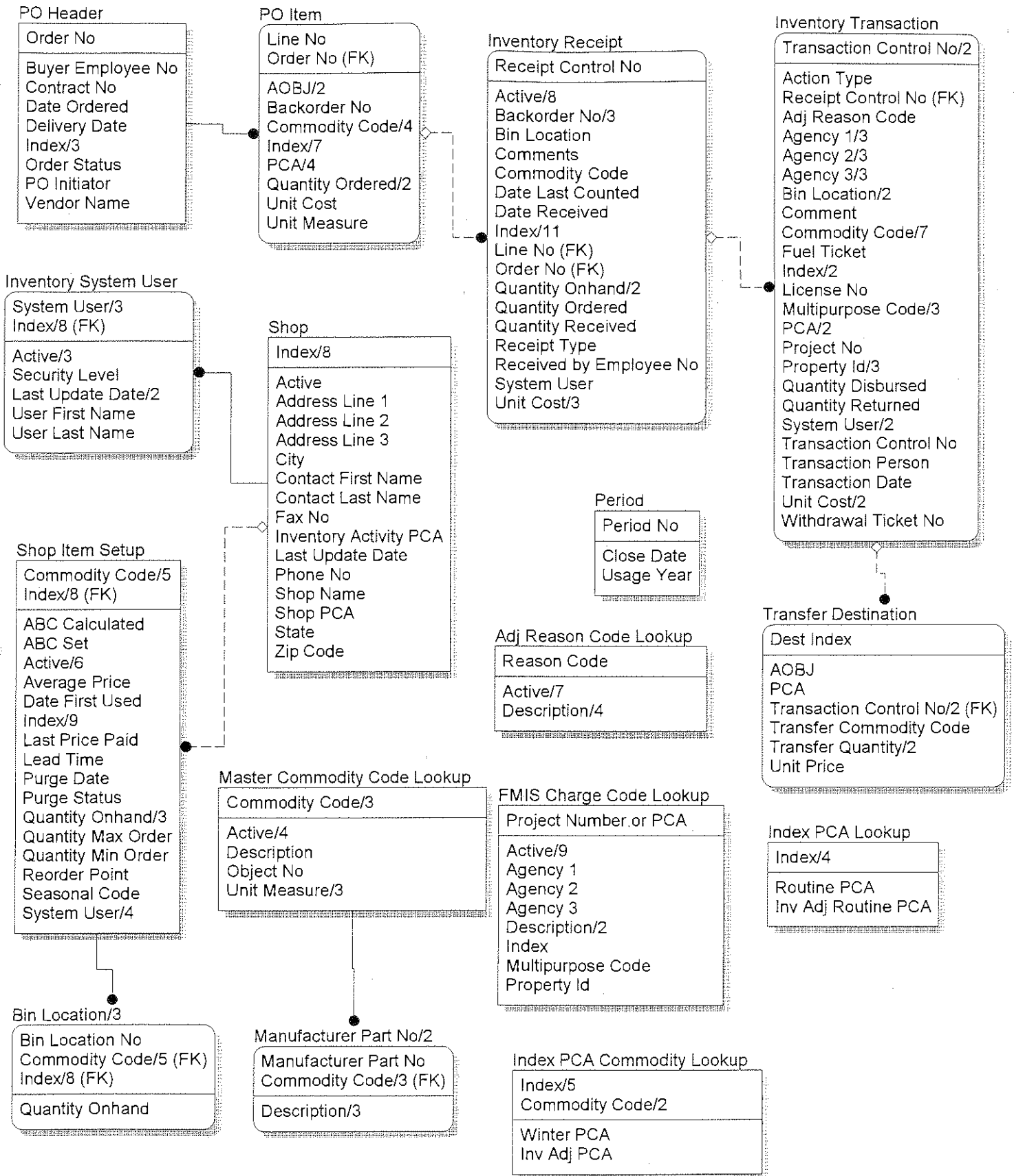
- **Entity** is a person, place, thing or concept that has characteristics of interest to the organization. An entity is something about which we store data. Example of entities are: shop, shop employee, purchase order etc.
- **Business Relationship** is a reason (of relevance to the organization) why entities from one or from two entity types may be associated. A business relationship is a named convention or association between entity types that embodies some relevant information of value to an organization. Business relationships are shown by a line connecting one entity to another.

## **TO-BE Data Dictionary**

The Data Dictionary is used to augment the IDEF1X Data Model and contains the following parts:

- Entity Name
- Attribute Name
- Attribute Definition

**SHA TO-BE IDEF1X INVENTORY DATA MODEL**



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## SHA TO-BE IDEF1X DATA DICTIONARY

30-Mar-98

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Entity Name	Entity Description	Attribute Name	Attribute Description
<b>Adj Reason Code Lookup</b>	<b>The code used to explain or justify why an adjustment is necessary.</b>	Active	An indicator of whether the adjustment reason code is active.
		Description	The description of the adjustment.
		Reason Code	The reason for the adjustment. Valid values are: annual physical count, inventory spot count, other. If other is entered, then the comment field in inventory transaction must be filled in.
<b>Bin Location</b>	<b>The physical inventory item storage location in a shop.</b>	Bin Location No	The physical location in the shop where the inventory item is placed.
		Commodity Code	The stock number.
		Index	The shop number
		Quantity Onhand	The quantity of shop item available.



Entity Name	Entity Description	Attribute Name	Attribute Description
FMIS Charge Code Lookup	The data downloaded daily from FMIS (Financial Management Information System). This contains the project number or PCA against which inventory items are charged.	Active	An indicator of whether the charge code is valid.
		Agency 1	The charge number for tasks. (e.g. mechanics)
		Agency 2	The charge number for location.
		Agency 3	The charge number for facility. (e.g. highway, interstate, bridge.)
		Description	The project or PCA description.
		Index	The shop number.
		Multipurpose Code	The reason for an accident report.
		PCA	The program cost account.
		Project No	The number of the project against which charges are made.
		Property Id	A unique number assigned to facilities, piece of equipment, vehicle.
Index PCA Commodity Lookup	The inventory interface lookup table which uses the index and commodity code to lookup the winter PCA/Inventory Adjustment PCA.		

<b>Entity Name</b>	<b>Entity Description</b>	<b>Attribute Name</b>	<b>Attribute Description</b>
		Commodity Code	The stock number.
		Index	The shop number.
		Inv Adj PCA	The program cost account to create valid inventory adjustment postings.
		Winter PCA	The program cost account to create valid winter postings.
<b>Index PCA Lookup</b>	<b>The inventory interface lookup table which uses the index to lookup the routine PCA and/or inventory adjustment routine PCA.</b>		
		Index	The shop number.
		Inv Adj Routine PCA	The program cost account to create inventory adjustment routine postings.
		Routine PCA	The program cost account to create routine postings.
<b>Inventory Receipt</b>	<b>The receipt of a purchase order or a transfer from another shop.</b>		
		Active	An indicator of whether the inventory receipt record is active or inactive.
		Backorder No	The backorder number used to indicate that a purchase order is open.

<b>Entity Name</b>	<b>Entity Description</b>	<b>Attribute Name</b>	<b>Attribute Description</b>
		Bin Location	The storage location where the inventory item is physically placed.
		Comments	Remarks or comments pertaining to an inventory receipt.
		Commodity Code	The inventory item stock number.
		Date Last Counted	The date that the inventory is last counted.
		Date Received	The date the inventory item is physically received.
		Index	The shop number.
		Line No	The purchase order line number.
		Order No	The purchase order number.
		Quantity Onhand	The quantity of shop item available.
		Quantity Ordered	The quantity of an inventory item on the purchase order.
		Quantity Received	The quantity of inventory item received.
		Receipt Control No	An internal number sequence number generated by the inventory system used to indicate the sequence in which inventory stock items are received.

<b>Entity Name</b>	<b>Entity Description</b>	<b>Attribute Name</b>	<b>Attribute Description</b>
		Receipt Type	The type of inventory receipt. Valid value are: normal receipt, transfer receipt, finished goods.
		Received by Employee No	The employee who received the inventory item.
		System User	The employee who creates the report. This is also the person that logged in. Note: The receipt report employee cannot be the same person as the purchase order initiator or the buyer employee.
		Unit Cost	The unit cost on the purchase order.
<b>Inventory System User</b>	<b>An individual authorized to use the inventory system.</b>		
		Active	An indicator to determine whether the inventory user is active.
		Index	The shop number.
		Last Date Updated	The last date on which the inventory system user record is updated.
		System User	The employee number assigned by the inventory system. This must match the network logon and the FMIS logon.
		User First Name	The user's first name.

Entity Name	Entity Description	Attribute Name	Attribute Description
<b>Inventory Transaction</b>	<b>An inventory transaction which may include one of the following: withdrawal, adjustment, transfer from, return to stock, or fuel withdrawal.</b>	User Last Name	The user's last name.
		User Security Level	The valid user security levels are: 1 - System Administrator, 2 - General User (The General User can read and produce reports as well as browse screens), 3 - Inventory User (The Inventory User has all the General User privileges plus has the ability to perform receipts, update, initiate, and post non posted inventory transactions). Note: The initiation of purchase order occurs in FMIS and security pertaining to the purchase order initiation is not in the scope of the inventory system.
		Action Type	The types of inventory transactions. The valid values are: withdrawal, adjustment, transfer from, return to stock, fuel withdrawal.
		Adj Reason Code	The adjustment reason code. Valid values are: spot count, annual physical count, and other.

Entity Name	Entity Description	Attribute Name	Attribute Description
		Agency 1	The charge number for tasks.
		Agency 2	The charge number for locations.
		Agency 3	The charge number for facilities. (e.g. highway, interstate, brigdes.)
		Bin Location	The storage location where the inventory item is physically assigned.
		Comment	Additional information with reference to an adjustment reason code. This is mandatory if the adjustment reason code "other" is selected.
		Commodity Code	The stock number.
		Fuel Ticket	The fuel ticket number. Note: This is mannally entered.
		Index	The shop number.
		License No	The vehicle license number used with a fuel withdrawal.
		Multipurpose Code	The reaons for an accident.
		PCA	The program cost account.
		Project No	The number of the project against which charges are made.
		Property Id	A unique number assigned to facilities, pieces of equipment, vehicles.

<b>Entity Name</b>	<b>Entity Description</b>	<b>Attribute Name</b>	<b>Attribute Description</b>
		Quantity Disbursed	The physical quantity that is issued on the withdrawal to the receiver for an adjustment.
		Quantity Returned	The quantity that is returned to stock.
		System User	The person responsible for the inventory transaction. This is also the person who is logged into the system.
		Transaction Control No	An internal sequence number generated by the inventory system to indicate the sequence in which inventory transactions occur.
		Transaction Date	The date on which the inventory transaction occurred.
		Transaction Person	The person who performs the inventory transaction. (Valid values are: Physical Count Person, Receiver, Returned by Person, Withdrawal Person)
		Unit Cost	The average unit cost for one inventory item
		Withdrawal Ticket No	A sequential number that identifies all transactions pertaining to a withdrawal.
<b>Manufacturer Part Number</b>	<b>The manufacturer's part number associated with an SHA inventory commodity code.</b>		

<b>Entity Name</b>	<b>Entity Description</b>	<b>Attribute Name</b>	<b>Attribute Description</b>
		Commodity Code	The stock number.
		Description	The description of the manufacturer part.
		Manufacturer Part No	The manufacturer's part number that is associated to a commodity code.
<b>Master Commodity Code Lookup</b>	<b>The valid SHA inventory system stock codes.</b>		
		Active	An indicator of whether the stock code record is active.
		Commodity Code	The stock number.
		Description	The stock code description.
		Object No	The agency object code associated with a specific commodity code. This is used as a charge code. There is a one to one relationship with the commodity code and the PCA. However, there is a one to many relationship between the PCA and the commodity code.
		Unit Measure	The unit of measure.
<b>Period</b>	<b>The table which defines the accounting period for reports</b>		
		Close Date	The date on which a period/year is closed.



<b>Entity Name</b>	<b>Entity Description</b>	<b>Attribute Name</b>	<b>Attribute Description</b>
		Period No	The number of the state fiscal period (e.g. month 1 = July, month 2 = August, etc.)
		Usage Year	The state fiscal year.
<b>PO Header</b>	<b>The purchase order document passed from FMIS that carries the 9060 object, stock number with an "S" prefix, and an index number for a valid inventory location.</b>		
		Buyer Employee No	Issue: The buyer id is passed down from the FMIS system when purchase orders are placed in FMIS. The current inventory system uses its own employee numbers.
		Contract No	The legal document allowing the inventory item to be procured.
		Date Ordered	The post date of the purchase order.
		Delivery Date	The scheduled delivery date of the inventory.
		Index	The shop number.
		Order No	The document number in FMIS.

Entity Name	Entity Description	Attribute Name	Attribute Description
PO Item	The purchase order item on the purchase order document.	Order Status	The status of the purchase order. Valid values are open or closed. The inventory system must update the order status to receive (100% received on a purchase order), partial (anything less than 100% received on the purchase order). When FMIS closes the purchase order, the purchase order will disappear off the screen.
		PO Initiator	The individual generating the purchase order document in FMIS.
		Vendor Name	The vendor name.
		AOBJ	The agency object code.
		Backorder No	The backorder number used to indicate that the purchase order is open.
		Commodity Code	The stock number.
		Index	The shop number.
		Line No	The line number on the purchase order.
		Order No	The purchase order number.

Entity Name	Entity Description	Attribute Name	Attribute Description
		PCA	The program cost account used to determine the budget that is hit.
		Quantity Ordered	The quantity ordered.
		Unit Cost	The unit cost on the purchase order.
		Unit Measure	The unit of measure. (e.g. each, tons, gallons, etc.)
<b>Shop</b>	<b>An inventory storage location. (Note: This table will be maintained by IMS.)</b>		
		Active	An indicator of whether the shop record is active.
		Address Line 1	The shop's address line 1.
		Address Line 2	The shop's address line 2.
		Address Line 3	The shop's address line 3.
		City	The city in which the shop is located.
		Contact First Name	The shop's point of contact first name.
		Contact Last Name	The shop's point of contact last name.
		Fax No	The shop's fax number.
		Index	The shop number.

<b>Entity Name</b>	<b>Entity Description</b>	<b>Attribute Name</b>	<b>Attribute Description</b>
		Inventory Activity PCA	The Program Cost Account that is assigned for all inventory activity for a specific shop. This is used for relief for return to stock, adjustments, and transfers.
		Last Update Date	The last date on which the shop's information has been updated.
		Phone No	The shop's phone number.
		Shop Name	The shop name.
		Shop PCA	The program cost account for the shop.
		State	The state in which the shop is located.
		Zip Code	The zip code for the shop.
<b>Shop Item Setup</b>	<b>A master table of valid commodity codes for which a shop.</b>		
		ABC Calculated	An analysis tool used to track inventory usage based on quantity. "A" items are used most frequently. Valid values are: A,B,C, N/A.
		ABC Set	This allows the user to override the ABC calculated and set his/her own ABC values for an inventory item.

<b>Entity Name</b>	<b>Entity Description</b>	<b>Attribute Name</b>	<b>Attribute Description</b>
		Active	An indicator of whether the shop item setup is active.
		Average Price	The shop's average price for the stock item using an average cost inventory method.
		Commodity Code	The stock number.
		Date First Used	The date that the stock item is first used.
		Index	The shop number.
		Last Price Paid	The last price paid for the shop item.
		Lead Time	The time it takes to order and receive the stock item.
		Purge Date	The date on which the shop item is purged.
		Purge Status	The status of the shop purged item.
		Quantity Max Order	The maximum quantity order based on history. Currently this is set manually. A requirement is that the system reorder points based on min/max and seasonal code and with an override capability.
		Quantity Min Order	The minimum quantity order based on history. Currently this is set manually.

<b>Entity Name</b>	<b>Entity Description</b>	<b>Attribute Name</b>	<b>Attribute Description</b>
		Quantity Onhand	The quantity of shop item available.
		Reorder Point	The system generated reorder point base on min, max usage, and lead time.
		Seasonal Code	This identifies whether an inventory item has more usages during certain times of the year.
		System User	The person updating the shop item setup record.
<b>Transfer Destination</b>	<b>The shop which receives the transfer in a transfer inventory transaction.</b>		
		AOBJ	The agency object code. This should be set to 9060.
		Dest Index	The shop number to which the inventory item is transferred.
		PCA	The inventory activity PCA for the receiving shop.
		Transaction Control No	An internal sequence number generated by the inventory system used to indicate the sequence in which inventory transactions occur.
		Transfer Commodity Code	The stock number of the item to be transferred.

Entity Name	Entity Description	Attribute Name	Attribute Description
		Transfer Quantity	The quantity of the inventory items that are to be received at the destination shop.
		Unit Price	The unit price of the inventory item.