

TOR Analysis: A Diagnostic Training Tool



Above all, TOR scrutinizes the supervisory-management aspects of accident causation, an area insufficiently probed by many investigations.

ABSTRACT: The author introduces a method of locating and defining the operational errors which underlie the daily load of headaches—snafus, ball-ups, errors, rejects, rework, waste—and accidents and injuries. The diagnostic results and the learning situation created by the process make the method of interest to the safety professional, to the training staff, and to line managers and supervisors.

TOR Analysis is a quite simple process. The technic may be demonstrated in moments, though its exposition on paper may take a bit longer. It is essentially a group process, but it can be applied in silent cogitation by a sole person.

A Sort of Instant Case Study

In any case, its effect is to create a sort of instant case study. Unlike the typical case study, however, it does not deal with hypothetical events in a hypothetical organization with hypothetical people leading to hypothetical insights. Rather, a TOR group deals with real events in their own organization. TOR Analysis is triggered by those real events, creating a learning situation of intense involvement, and leading to real insights into their own organization.

TOR must first be perceived as a process, a thing

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to do in step-by-step sequence. That sequence will be herein explained. The explanation should enable anyone who wishes to conduct his first TOR sessions. But TOR must also be perceived on two other levels. It must be perceived as a training tool which creates a learning situation as the group pursues the step-by-step process. And it must finally be perceived as a tool to assist in the diagnosis of the causes of an untoward event.

Technic of Operations Review

TOR stems from the designation, "Technic of Operations Review."¹ Hence, the process is called TOR Analysis; and we have TOR sessions, and TOR groups, and TOR leaders. Technic of Operations Review was originally conceived as a tool for smaller business operations, as a tool to be used by line managers and supervisors in the absence of staff help. Larger organizations, blessed with staff help, have used it for the very reason that it can be used by line personnel.

Before considering how to conduct TOR Analysis, the nature of Technic of Operations Review might be explained. This is best done by studying the TOR Analysis form, popularly called TOR Yellow Sheets. As a TOR session begins, each person has one before him. It's the only item essential to conduct a TOR session.

A glance at the TOR Analysis form quickly reveals that TOR Analysis deals with the supervisory-management factors which underlie the events of the work day. In the language of safety management, it's a page of "operational errors" set forth under eight headings.

These operational errors (and many more whose inclusion would have made TOR Analysis unworkable)—these operational errors exist, or happen, or are committed in every organization. The more they exist the more sloppy the organization. The more they exist, the more they combine in unexpected and often improbable ways to produce the daily load of headaches—snafus, ball-ups, errors, rejects, rework, waste—and accidents and injuries.

"Operational error has occurred whenever unplanned and undesired results stem from the acts

STEPS OF TOR ANALYSIS

Minutes	
5 to 10	Get FACTS on the table.
5 to 10	STATE proximate cause.
20 to 30	TRACE underlying contributing causes.
30 to 50	
	ELIMINATE: reconsider; isolate important factors.
	SEEK feasible corrective action.

The steps of TOR Analysis will usually fit into a one-hour supervisor's meeting, with time available for the final two steps.

Figure 1.

and decisions of supervisory management, or the failure to act or decide."² TOR is triggered by one of those unplanned and undesired results. Examples are endless—the truck dispatched to the wrong city, "\$9,000 worth of scrap," an accident, an injury—all are unplanned and undesired events behind which lie operational errors. TOR probes into the supervisory-management deficiencies which caused them or failed to prevent them. Accident investigation seldom dwells on this aspect of accident causation, yet deficiency in supervisory-management (usually more rather than less so) is a causative factor in any accident.

At this point the not-too-hasty reader has questions which may be dealt with in a forthcoming question-and-answer section. A final section will deal with the simple but crucial role of the TOR leader. For now the necessary task is to describe the steps of TOR Analysis.



The TOR leader is pictured as a line supervisor or manager not necessarily possessing skills as a conference leader or a teacher. Talent as a conference leader will help, but learning takes place even if the TOR leader merely keeps the TOR process on its tracks.

How To Conduct TOR Analysis

Figure 1 sets forth the steps of TOR Analysis. The explanation can be demonstrated in 10 minutes. In 10 minutes, a group that never heard of TOR will have their heads bent over the TOR Yellow Sheets in earnest discussion. In this exposition, the explanation of the steps has been intermixed with certain lessons of experience ("list vertically!"), and an attempt has been made to describe the group interaction and the nature of the learning situation. Forewarned, this should not distract from the main purpose.

In a typical TOR group, all supervisors in the same organization, the steps of TOR Analysis need not be explained at all. The TOR leader simply directs the group through the process. The steps need to be explained only in a classroom situation whose purpose is to demonstrate TOR. In that case, the explanation need go no further than the TRACE step, leaving the final two steps to be explained when they get there in the demonstration.

If a demonstration is thought to be necessary before applying TOR to a real life situation, a one-page incident has been used successfully.³ Far more effective has been TOR Analysis of an incident portrayed by a film. The movie displays facts far more

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About The Author



D. A. Weaver devised "Technic of Operations Review," from which this article is drawn, as part of his work as Policyholder Education Director for Employers Insurance of Wausau. It is part of an educational approach designed to assist policyholders large and small.

Before he assumed his present position 10 years ago, he served on the faculty of the Traffic Institute at Northwestern University; and for seven years served as a consultant on safety management to industry and developed courses in industrial and motor transportation safety at Purdue University. Earlier experience included five years at the Institute of Public Safety at Penn State.

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The record of recurring operational errors, drawn from diverse incidents, serves to pinpoint frequent deficiencies, to define training needs, and to give direction to the thrust for improvement.

effectively than many pages of reading. Turn the projector off at that moment when the scenario undertakes to resolve the questions raised by the film. At that moment, let the TOR leader take over. Two films, "Fatal Accident Report"⁴ and "The Unplanned,"⁵ have been used in this manner, but any film which centers on an incident might be used.

As the group assembles, they must have in mind some incident, some unplanned and undesired result, some snafu, ball-up, or accident which triggered the calling of the TOR session. The first step is to get FACTS on the table. The incident is described. All question each other to bring out the facts. One can picture the submission of reports of prior investigation, and if such information exists, it should be brought in. In point of fact, this first step is seldom that elaborate. Usually in 5 or 10 minutes all anyone knows has been drawn out. As discussion becomes redundant or begins to fragment into problem-solving, the TOR leader quells the incipient bull session by demanding an answer to the next step.

Step two requires the group to STATE the proximate cause. They select this from the TOR Yellow Sheet. From the whole page, what one number best states the cause? In a few moments first one and then another proposes a number. Three, four, five numbers may be advanced. They must reach consensus on just one. They debate and discuss. They ask what the terms mean and define them to each other. They are learning. The TOR leader presses for decision, presses to limit the field. In 5 or 10 minutes, since they are told they must, the group settles for one number as the beginning point of TOR Analysis. Holdouts are placated with the assurance that their favorite number will be reconsidered in the trace step next. Above all, they are learning. They are applying the words and concepts

to their own organization and their own ways of doing things.

To STATE the proximate cause of an accident or injury, start in Section 7. This block deals with personal traits and is used only with accidents and injuries. If nothing fits as a proximate cause in Section 7, determine a proximate cause anywhere from the page.

Having stated the proximate cause, each person writes that number at the top of a sheet of paper. Next they TRACE contributing factors. To the right of each cause factor there are one or more trace numbers. List these vertically under the beginning number. Each is now brought up in turn and discussed *briefly* (perhaps two minutes each). Brevity is impelled by the point of the discussion: "Did this factor contribute to cause the incident? Is it in or out, yes or no?"

If it's "in," the trace numbers that go with it are added to the list. If it's "out," just cross it out and go to the next number. Figure 2 illustrates the TRACE step.

Every "in" number adds to the vertical list of trace numbers, and each is considered in turn as the group proceeds down the list. At first the list seems to grow rapidly, but the process soon reverses itself and tracing comes to a natural end, usually in 20 or 30 minutes.

The TRACE step is a quick overview. The group quickly learns that this is not the moment for in-depth discussion. Sometimes a number is quickly struck out because it clearly did not contribute to the incident. Others are obviously "in." When discussion threatens to turn into a bull session, the

THE TRACE STEP

TRACE starts with one number, producing a growing list of contributing factors, each of which is considered in turn, and comes to a natural close by a series of small "in" or "out" decisions.

35 Orders 40 Morale 46 Team 13 Correction 15 Tell Why	Brief discussion rejects #40 and #46, but #13 and #15 seem to apply, producing cross reference to six additional items.
42 Acts 20 Duties 30 By Passing 44 Initiative 24 Pressure 83 Span	Brief discussion rejects four items, but #20 and #83 produce cross reference to another six items, one of which (#44) you've already considered and rejected.
44 34 Decision 14 Instruction 53 Prop. Loss 12 Training 86 Staffing	Discussion rejects all but #14, which cross references to three additional items.
15 16 Listen 42	You've already rejected two of these, and brief discussion rejects #16. The trace step is complete.

Figure 2.

TOR leader presses for decision: "Is it 'in' or is it 'out'?"

Thus, by a series of small decisions, the group is led along in a review of its own organization. They will question and disagree. In the process, they will perceive supervision not as words but as facts in their daily work.

When tracing comes to its natural close, the group has a score or more of numbers in a vertical list, many of which have crossed out. It's a good idea at this point to make a neat list of the "in" numbers, the factors which the group, in hasty overview, believes contributed to the incident. The incident, by TOR Analysis, has become a sort of instant case study, producing a list of perhaps a dozen factors which need further consideration. Since, however, the case concerns real, not hypothetical, events the situation calls for a practical turn. That's the purpose of the final two steps in TOR Analysis.

These steps seek to ELIMINATE some of the contributing factors, to isolate the important factors, and finally to SEEK feasible corrective action. A dozen things cannot be corrected at once. We must ELIMINATE in order to focus on the important factors. The list of contributing factors is now discussed in more depth. Some items can be eliminated for whatever reason seems appropriate to the group—because exposure and discussion was itself sufficiently corrective, because it's relatively unimportant, for whatever reason.

The ELIMINATE step merges insensibly into "SEEK feasible corrective action." Both steps tend to be simultaneous, a process of focusing the lesson to be learned, of defining the problem, and discussing what can be done about it. The SEEK step is problem solving. TOR leads to problem solving, but it does not produce a slide-rule solution.

What happens depends on many things. Often plans can be proposed and implemented within the powers of the group. Sometimes the problems extend beyond them. Sometimes the SEEK step loses its way and turns into a bull session. Action is not the sole purpose of TOR Analysis, and not all sessions end in definitive action. However, action not knowledge is the purpose of education. TOR Analysis seeks action in its final step.

What then has been gained? As a result of insights gained, individual supervisors can improve their performance even though group or company action may not be achieved. The causes for the trigger incident remain as a valid diagnosis even if corrective action does not immediately follow. The cumulative record of a series of TOR sessions creates a deeper diagnosis, revealing recurring operational errors which appear again and again. The record of these recurring operational errors, drawn from diverse incidents, serves to pinpoint frequent deficiencies, to define training needs, and to give direction to the thrust for improvement.

Questions and Answers

- Q. Supervisory-management improvement is sought by many means. What advantage is there in the TOR method?
- A. Perhaps the advantage that TOR gives words to real life situations, gives words to facts observed in the shop. Learning moves from the abstract to the concrete. Perhaps, also, advantage lies in the fact that the smaller firm, or the line supervisor, can conduct successful TOR sessions without necessarily possessing skill as a conference leader or teacher.
- Q. Is TOR Analysis problem solving?
- A. It is offered as a tool to diagnose and define rather than to solve. In part, it's a question of semantics. The key fact is that TOR is triggered by an incident not a problem.⁶
- Q. Is TOR Analysis a process of accident investigation?
- A. TOR produces no facts other than those already known by some member of the group. Therefore, it is not investigation. Rather, the results of accident investigation should be presented at the TOR session.
- Q. What is gained by presenting the facts of accident investigation at a TOR session?
- A. The hasty investigation typical of the majority of accidents, and the paucity of facts, will be observed. It may expose facts which have been overlooked, and expose conclusions "proven" with a neat array of selected facts. Above all, it scruti-



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nizes the supervisory-management aspects of accident causation, an area insufficiently probed by many investigations.

Q. In cases of accident or injury, TOR begins in Section 7 on personal traits. Why?

A. We accept personal traits as a factor in accident causation, often expressed in the form of blame. TOR begins there but then traces into supervisory-management factors over which supervisors may have more control.

Q. Suppose nothing in Section 7 fits?

A. The items in Section 7 merely hint at the rich jungle of physical and psychological factors in accident causation. If nothing fits, simply start a trace sequence in another block; that is, STATE the proximate cause in another block.

Q. Suppose we begin in Section 7 but all the trace numbers cross out?

A. That can happen. It means that some personal trait contributed to the accident, but the TOR group denies that it could have been controlled by supervisory action. Simply start another trace sequence in another block to see what else contributed.

Q. Who should be in a TOR group?

A. Normally, a manager and his subordinate supervisors, or a supervisor and his subordinate foremen. Interdepartmental incidents would require the presence of selected people from other units, or alternatively, the incident would be submitted to TOR Analysis at a higher echelon.

Q. Who is the TOR leader?

A. In smaller operations, the "boss" is TOR leader in the absence of staff help. In larger operations, staff may introduce TOR and teach the method, but its regular use would seem to depend on line supervision.

Q. What about #45 "honest error?"

A. People do goof, and if that's all there is to an incident, TOR Analysis starts and stops at #45. Frequently, however, a long trace sequence stems from the decision to blame George, which is done tactfully by calling it an honest error.

The Role of the TOR Leader

The TOR leader is pictured as a line supervisor or manager not necessarily possessing skills as a conference leader or a teacher. With perhaps limited talent as a discussion leader, he directs the course of discussion and controls the aimless bull session by insisting on a series of small decisions.

He begins by telling why the TOR session was called and gives such facts as he knows. He calls on others for facts, and joins in questioning. In such a discussion, people tend to jump ahead. They often propose solutions and argue alternative proposals and tend toward an aimless bull session. The TOR leader controls this by pointing to the TOR form and asking the group to STATE the immediate cause. He calls for a decision.

As the group tries to STATE the immediate cause, the TOR leader insists that consensus must be reached on just one number. Disagreement and debate are desirable, for therein lies learning; but the aimless bull session must be controlled. Many skills can be brought to this task, but in their absence it is sufficient for the TOR leader to insist on decision.

The urge to decide also impels the TRACE step on its way. The TOR leader keeps the vertical list of trace numbers, and he directs attention to each number in turn so that all members of the group are considering the same point at the same time. And he asks for decision: "Is it in or is it out?" The TOR leader must be sufficiently dominant to keep the group on the same point and insist on decisions. Talent as a conference leader will help, but learning takes place even if the TOR leader merely keeps the TOR process on its tracks.

As the TRACE step ends, the discussion trends toward problem solving by eliminating minor factors and seeking corrective action. Skill as a conference leader becomes increasingly important as these steps proceed. The group at this point tries to agree on a procedure, or a recommendation, regarding their daily work. Sometimes this evolves with ease since the group has a common viewpoint as a result of TOR Analysis. Sometimes the TOR session has exposed issues not readily resolved and no conclusion can be reached. In that case the TOR leader defines issues and viewpoints and summarizes as best he can and brings the TOR session to a conclusion.

One quick demonstration would enable anyone to try TOR Analysis in his own organization. It is hoped that the same result has been achieved by the more tedious process of reading. That has been the purpose—to enable the reader to try TOR, to gather the experience of several TOR sessions, to evaluate its possible uses in his own organization. Complimentary supplies of the TOR form (TOR Yellow Sheets) are available from the author.

References

1. "How To Conduct TOR Analysis," 6 pages, by Employers Insurance of Wausau, Wausau, Wisconsin, 54401.
2. Weaver, D. A., "Symptoms of Operational Error," *ASSE Journal*, October, 1971.
3. "Mankator Co., Inc.," one-page incident to demonstrate TOR Analysis, Employers Insurance of Wausau, Wausau, Wisconsin, 54401.
4. "The Fatal Accident Report," 25 minutes, color, 1962. Sponsor—Employers Insurance of Wausau, Wausau, Wisconsin, 54401.
5. "The Unplanned," 20 minutes, color, 1971. Sponsor—Labour Canada, 3155 Cote de Liesse Road, Montreal 379, Quebec, Canada. Producer—National Film Board of Canada.
6. The difference between an incident and a problem is pursued further in Petersen, Daniel C., "Techniques of Safety Management," McGraw-Hill, 250 pages, 1971.

(See page 29 for TOR Yellow Sheet)

1 COACHING	3 AUTHORITY (Power to decide)	5 DISORDER	7 PERSONAL TRAITS (When accident occurs)
10 Unusual situation, failure to coach (new m.p., tool, equipment, process, material, etc.) 44, 24, 62	30 Bypassing, conflicting orders, too many bosses 44, 13	51 Work flow inefficient or hazardous layout, scheduling, arrangement, stacking, plating, routing, storing, etc. 41, 24, 31, 80	70 Physical condition — strength, agility, poor reaction, clumsy, etc. 44, 26, 65
11 No instruction. No instruction available for particular situation 44, 22, 24, 80	31 Decision too far above the problem 36, 83, 85	52 Conditions inefficient or unsafe due to faulty inspection, supervisory action, or maintenance 21, 32, 14, 86	71 Health — sick, tired, taking medicine 44, 24, 65
12 Training not formulated or need not forecast 24, 34, 85	32 Authority inadequate to cope with the situation 81, 83	53 Property loss. Accidental leakage or damage due to faulty procedure, inspection, supervision, or maintenance 43, 20, 80	72 Impairment — amputee, vision, hearing, heart, diabetic, epileptic, hernia, etc. 44, 24, 65
13 Correction. Failure to correct or failure to see need to correct 42, 20, 30	33 Decision exceeded authority 20, 26, 14	54 Clutter. Anything unnecessary in the work area. (Excess materials, defective tools and equipment, excess due to faulty work flow, etc.) 44, 36, 80	73 Alcohol — (if definite facts are known) 80
14 Instruction inadequate. Instruction was attempted but result shows it didn't take 15, 16, 42	34 Decision evaded, problem dumped on the boss 36, 14, 85	55 Lack. Absence of anything needed. (Proper tool, protective equipment, guards, fire equipment, bins, scrap barrels, janitorial service, etc.) 44, 36, 80	74 Personality — excitable, lazy, pool-oh, unhappy, easily distracted, impulsive, anxious, intiable, complacent, etc. 44, 13
15 Supervisor failed to tell why 44, 24, 83	35 Orders failed to produce desired result. Not clear, not understood, or not followed 40, 46, 13, 15	56 Voluntary compliance. Work group sees no advantage to themselves 40, 15, 41	75 Adjustment — aggressive, show off, stubborn, insolent, scores points and instruction, defies authority, antisocial, argues, timid, etc. 44, 13
16 Supervisor failed to listen 11, 81	36 Subordinates fail to exercise their power to decide 26, 12, 83, 85	57	76 Work habits — sleepy, confusion and disorder in work area, careless of tools, equipment and procedure 44, 13
17	37	58	77 Work assignment — unsuited for this particular individual 42, 65
18	38	59	78
19	39		79
2 RESPONSIBILITY	4 SUPERVISION	6 OPERATIONAL	8 MANAGEMENT
20 Duties and tasks not clear 44, 34, 14, 53	40 Merit, lenient, insecurity, lack of faith in the supervisor and the failure of the job 15, 56, 64, 80	60 Job procedure. Awkward, unsafe, inefficient, poorly planned 44, 32	80 Policy. Failure to assert a management will prior to the situation at hand 24, 31, 53
21 Conflicting goals 80, 33	41 Conduct. Supervisor sets poor example 13, 84	61 Work load. Pace too fast, too slow, or erratic 44, 51, 63	81 Goals. Not clear, or not projected as an "action image" 83, 85
22 Responsibility, not clear or failure to accept 26, 14, 54, 82	42 Unsafe Acts. Failure to observe and correct 24, 11, 52	62 New procedure. New or unusual tasks or hazards not understood 43, 44	82 Accountability. Failure to measure or appraise results 36
23 Dual responsibility 47, 34, 13	43 Rules. Failure to make necessary rules, or to publicize them. Inadequate follow-up and enforcement. Under enforcement or weak discipline 25, 36, 12, 52	63 Short handed. High turnover or absenteeism 80, 46, 61	83 Span of attention. Too many irons in the fire. Inadequate delegation. Inadequate development of subordinates 12, 85
24 Pressure of immediate tasks obscures full scope of responsibilities 36, 12, 51	44 Initiative. Failure to see problems and exert an influence on them 22, 34, 30	64 Unattractive jobs. Job conditions or rewards are not competitive 81, 46	84 Performance appraisals. Inadequate or done excessively on short range performance 20, 65
25 Back passing, responsibility not laid down 44, 26, 55, 60	45 Honest error. Failure to act, or action turned out to be wrong 10, 12, 15, 81	65 Job placement. Hasty or improper job selection and placement 80, 86	85 Mistake. Failure to support and encourage subordinates to exercise their power to decide 36, 33
26 Job descriptions inadequate 80, 85	46 Team spirit. Mgr. are not pulling with the supervisor 40, 21, 56	66 Co-ordination. Departments inadvertently create problems for each other (production, maintenance, purchasing, personnel, sales, etc.) 45, 35, 13	86 Staffing, assign full or part-time responsibility for related functions 66
27	47 Co-operation. Poor co-operation. Failure to plan for co-ordination 23, 25, 15, 66	67	87
28	48	68	88
29	49	69	89

Each section contains blank numbers. In your operation, TOR ANALYSIS may reveal factors in addition to those listed. TOR factors special to your organization. Invert these additional cause items under their proper heading, with a cross reference number (or numbers) leading to TOR factors controlling this special aspect.

